A close-up photograph of a bright green gecko with red spots on its head, resting on a dark, textured surface. The gecko's body is covered in a pattern of small, rounded scales.

# Herpetology

Biology 489

Luke J. Harmon

Fall 2019



FANDANGO  
MOVIECLIPS



FANDANGO  
MOVIECLIPS



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Office hours: after class

- Life Sciences South (LSS) 347
- or by appointment (these are welcome!)

Dr. Luke J. Harmon, LSS 347

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# BIOLOGY 489, HERPETOLOGY

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## Recent Posts

August 20, 2015

### **Macroevolution**

Lecture 1 on Macroevolution is here

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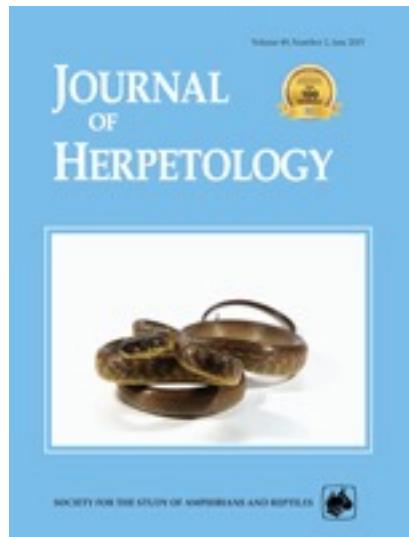
[lukejharmon.github.io/herpclass](http://lukejharmon.github.io/herpclass)

# Herpetology

FOURTH EDITION

F. HARVEY POUGH  
ROBIN M. ANDREWS • MARTHA L. CRUMP  
ALAN H. SAVITZKY • KENTWOOD D. WELLS  
MATTHEW C. BRANDLEY

(optional)



PETERSON FIELD GUIDES®

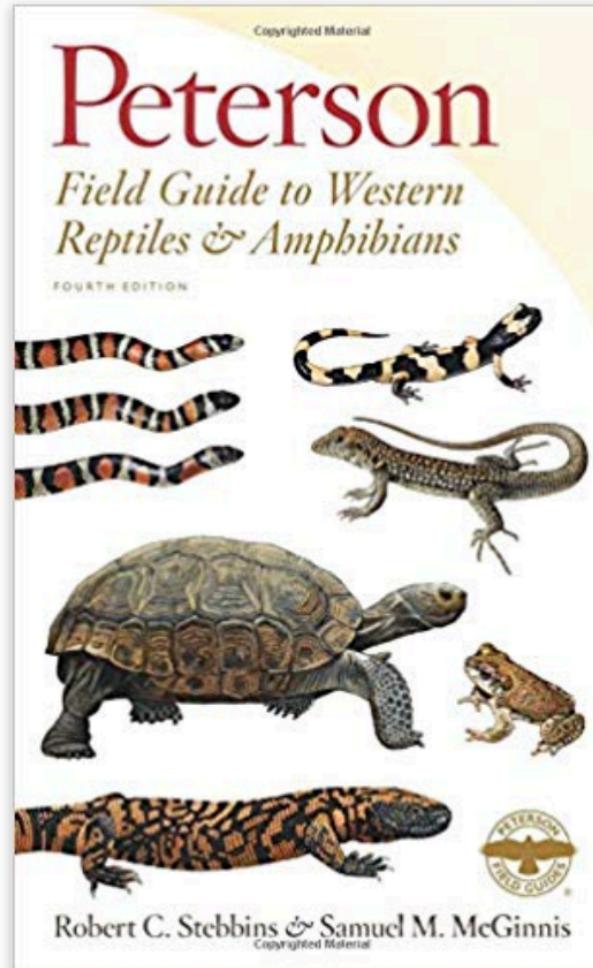
Western  
Reptiles and  
Amphibians

Third Edition



Robert C. Stebbins

required and you  
need it by next week!



Robert C. Stebbins & Samuel M. McGinnis

# Course grading

Weekly assignments	20%
Group Research Proposal	10%
Lab	25%
Exam I	15%
Exam II	15%
Final	15%
<hr/>	
	100%

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	100%

Class

Famous  
Herpetologists

# Course grading

Weekly assignments	20%
Group Research Proposal	10%
Lab	25%
Exam I	15%
Exam II	15%
Final	15%
<hr/>	
	100%

# Class Presentations

- Present a research proposal in lab
- 15 minute class presentations
- Small groups (3 or 4 students)
- Key components:
  - What is known?
  - What is your question?
  - How can you answer that question?
- **Turn in a written summary and a budget**

# Course grading

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Group Research Proposal	10%
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<hr/>	
	100%

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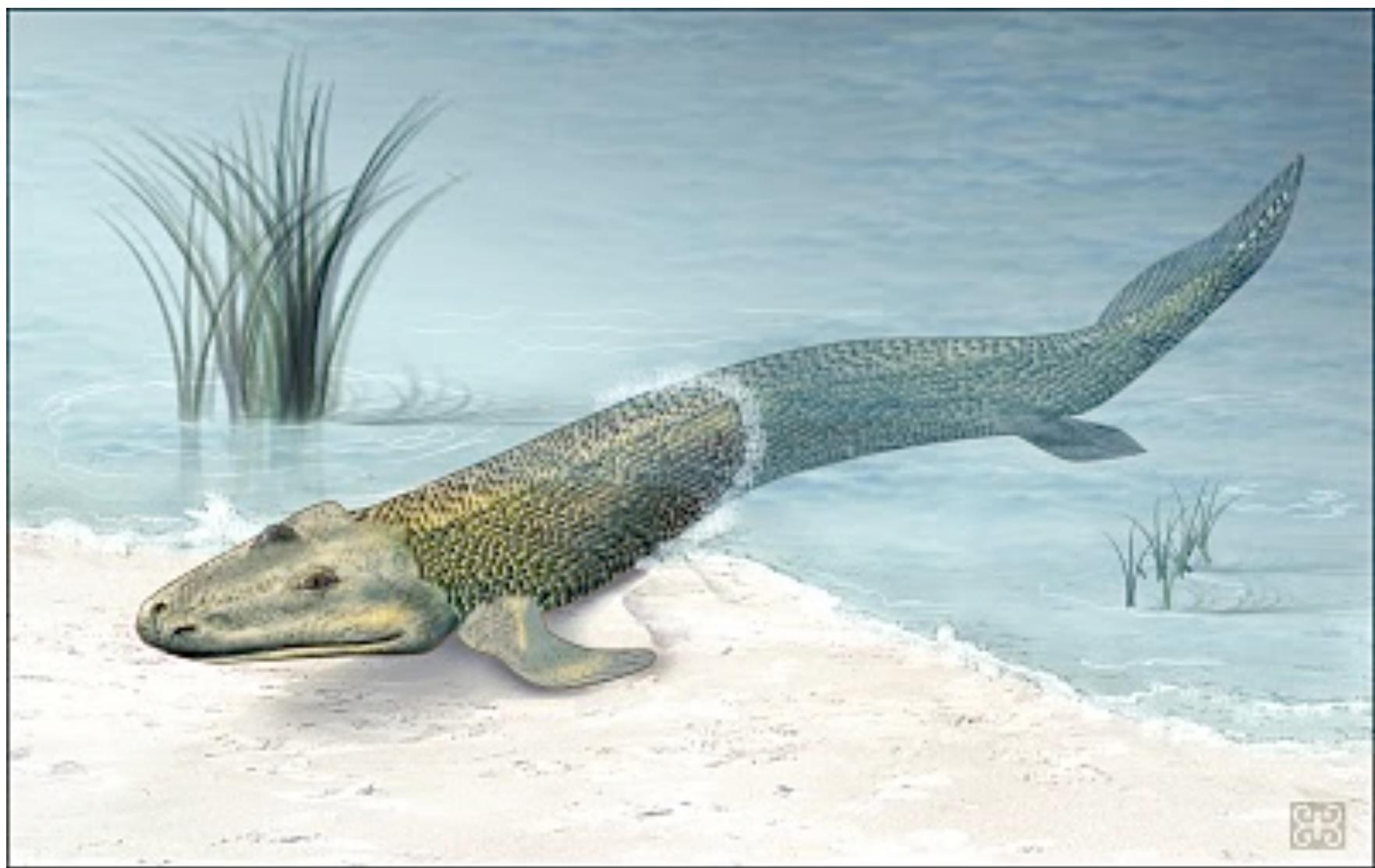
# Exams

- Exams are all short-answer questions
- The final will be **comprehensive**
- I will post examples of old exam questions on blackboard

# Policies

- Plagiarism and cheating: no thanks
- Make-up policy: let me know in advance; no make-ups for final
- Late assignments: 10% per day

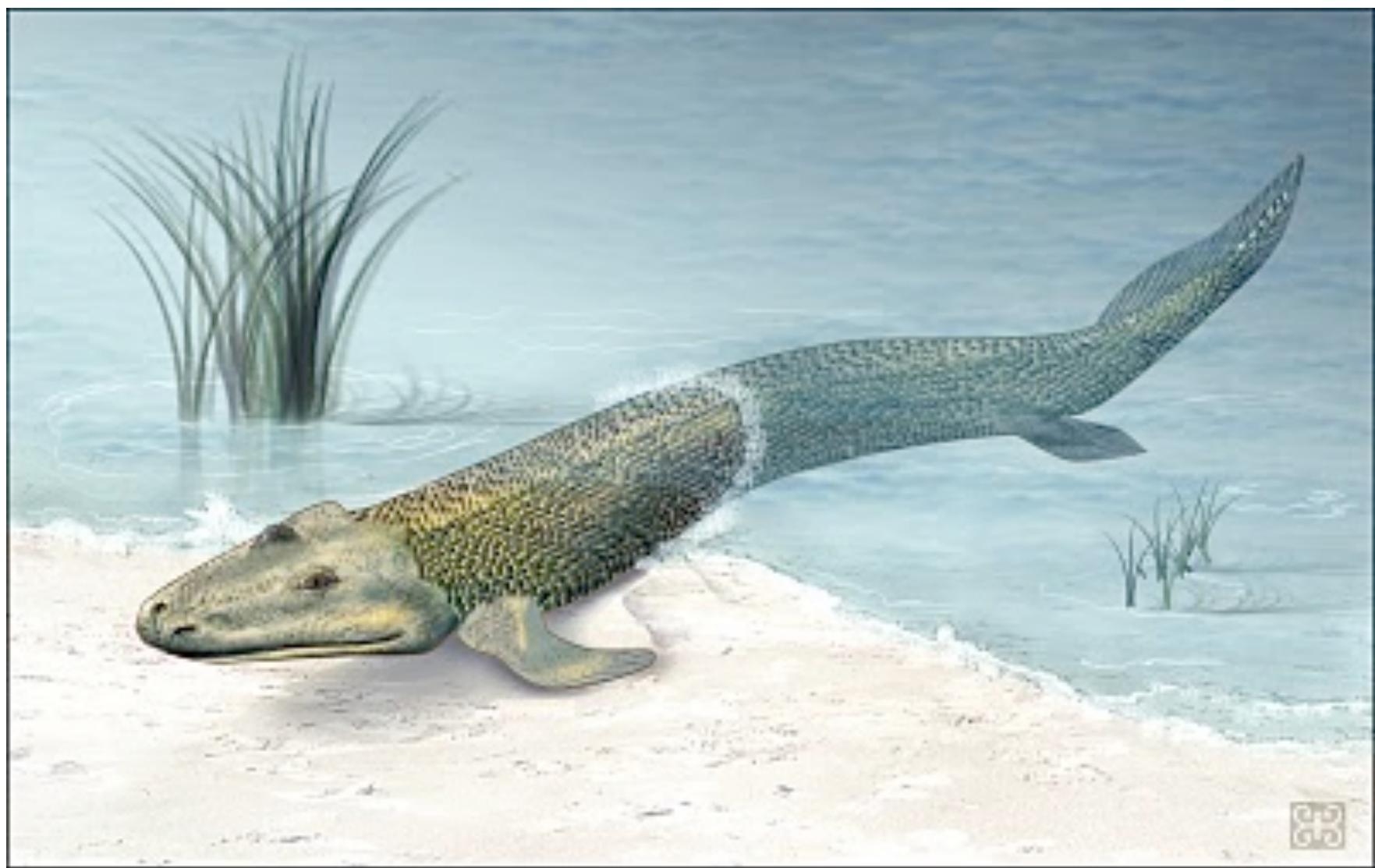
# Lecture 1: Where did reptiles and amphibians come from?



# Things you might think about the transition to land

Legs evolved for locomotion on land

Lungs evolved for breathing on land







# How do we learn about the origin of herps?

- Study relationships among living species
- Find and analyze fossils

# How do we learn about the origin of herps?

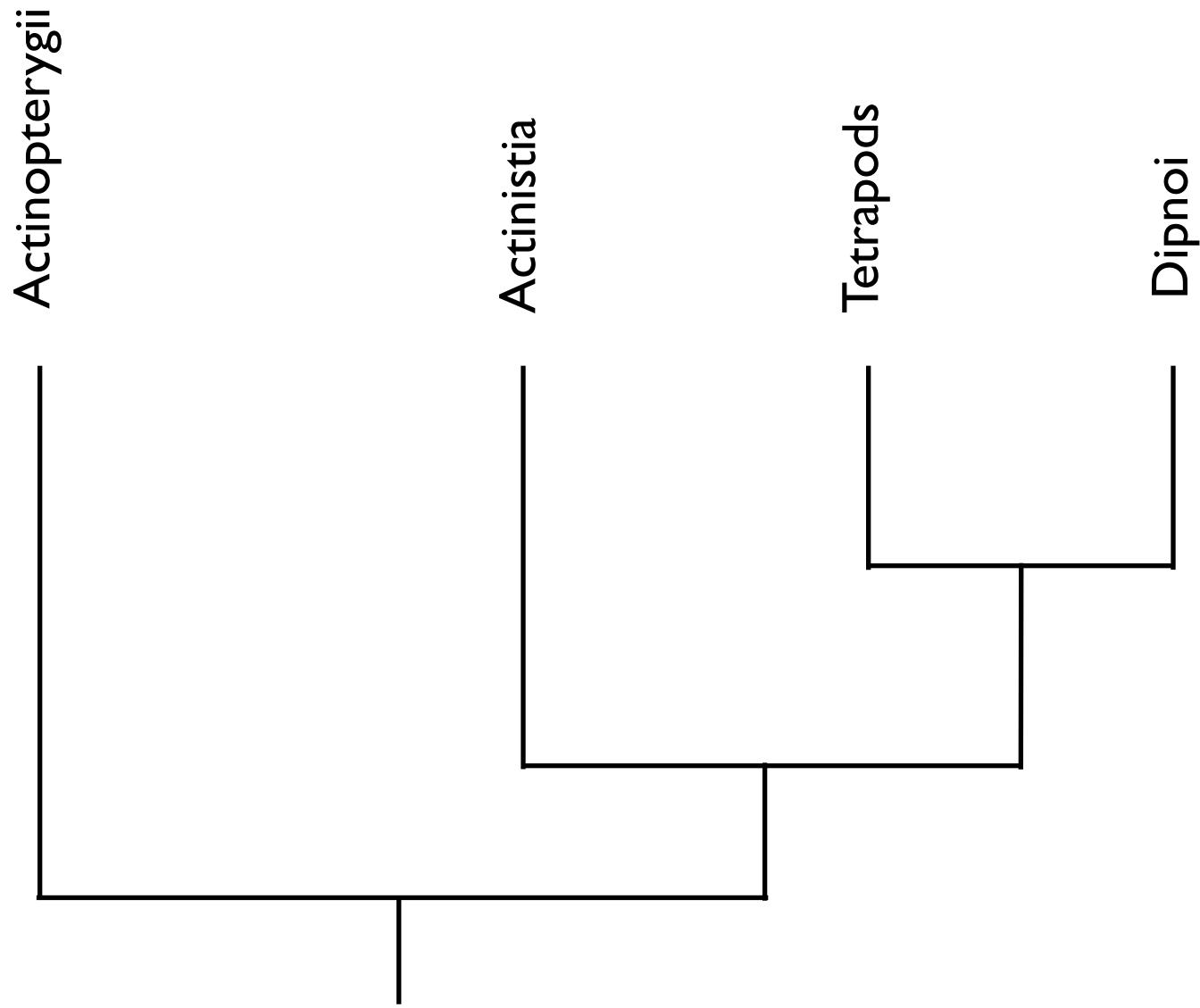
- Study relationships among living species
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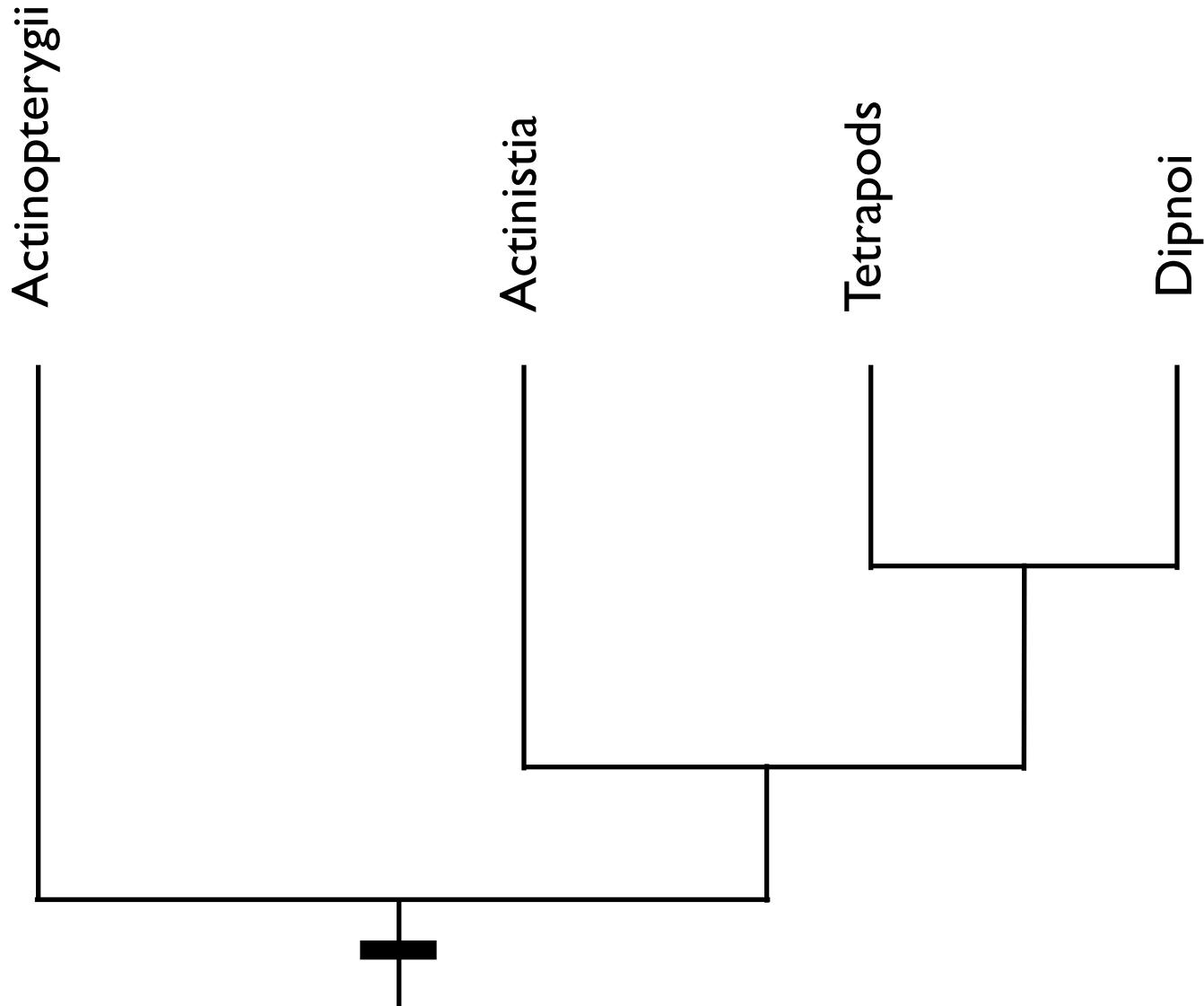


These are all  
tetrapods



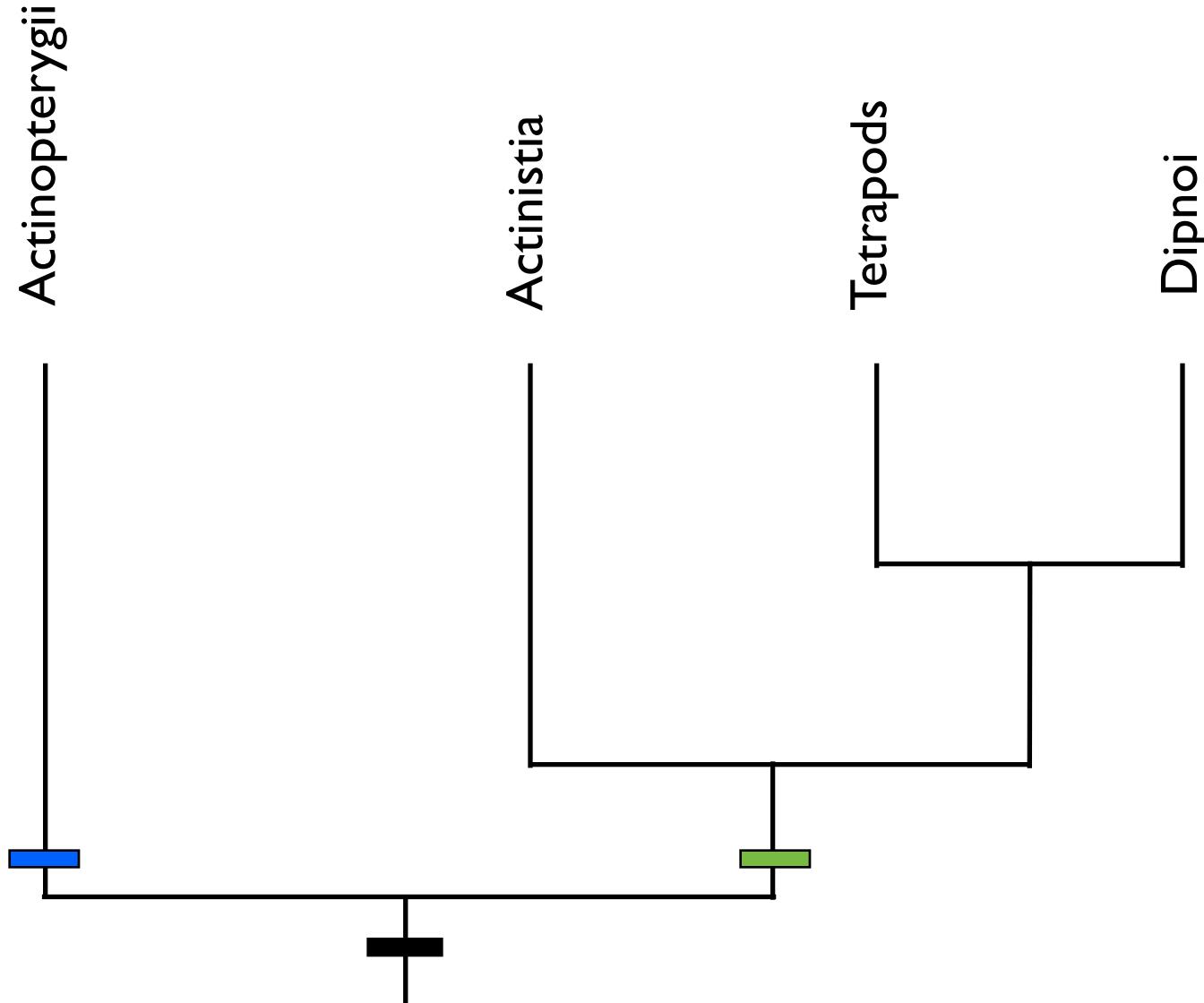


# Osteichthyes (bony fishes)

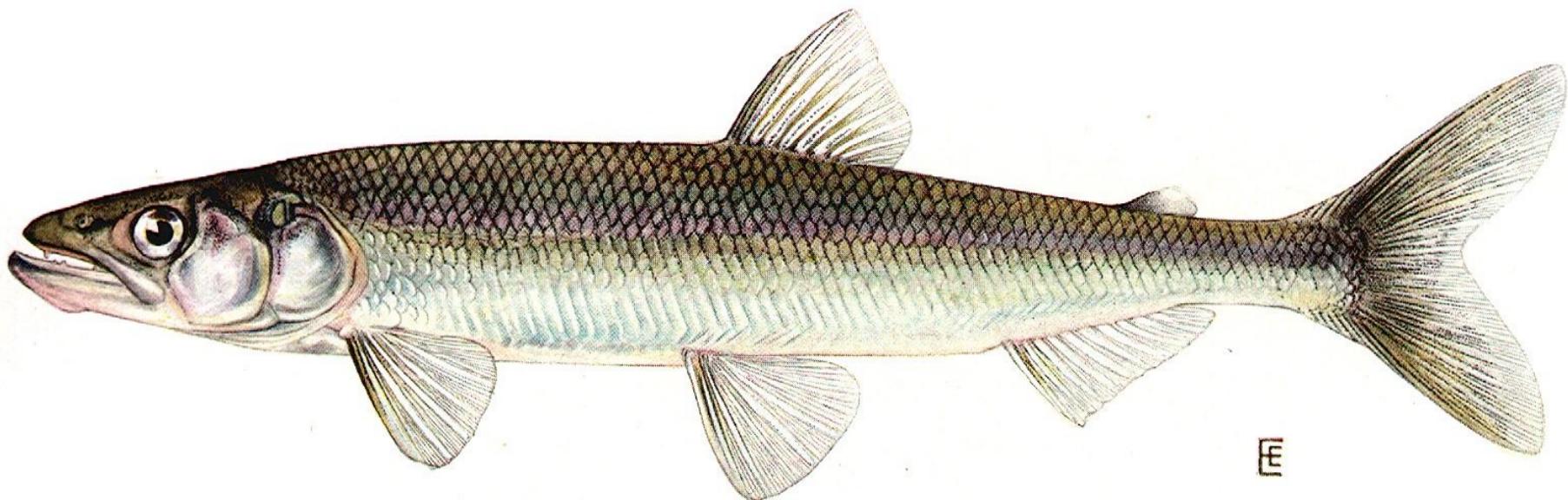


# Osteichthyes (bony fishes)

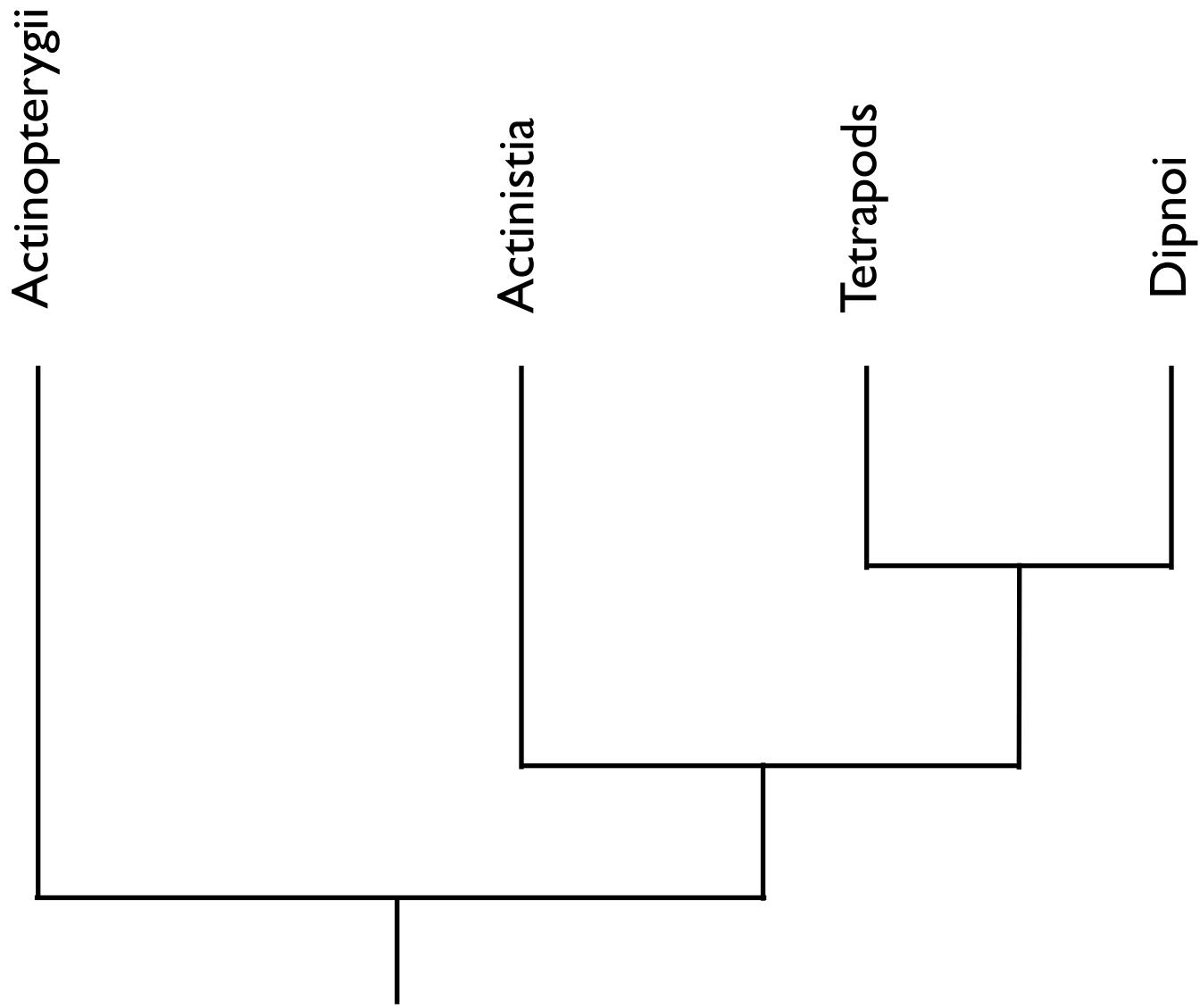
= Actinopterygii (ray-finned fishes) + Sarcopterygii (lobe-finned fishes)



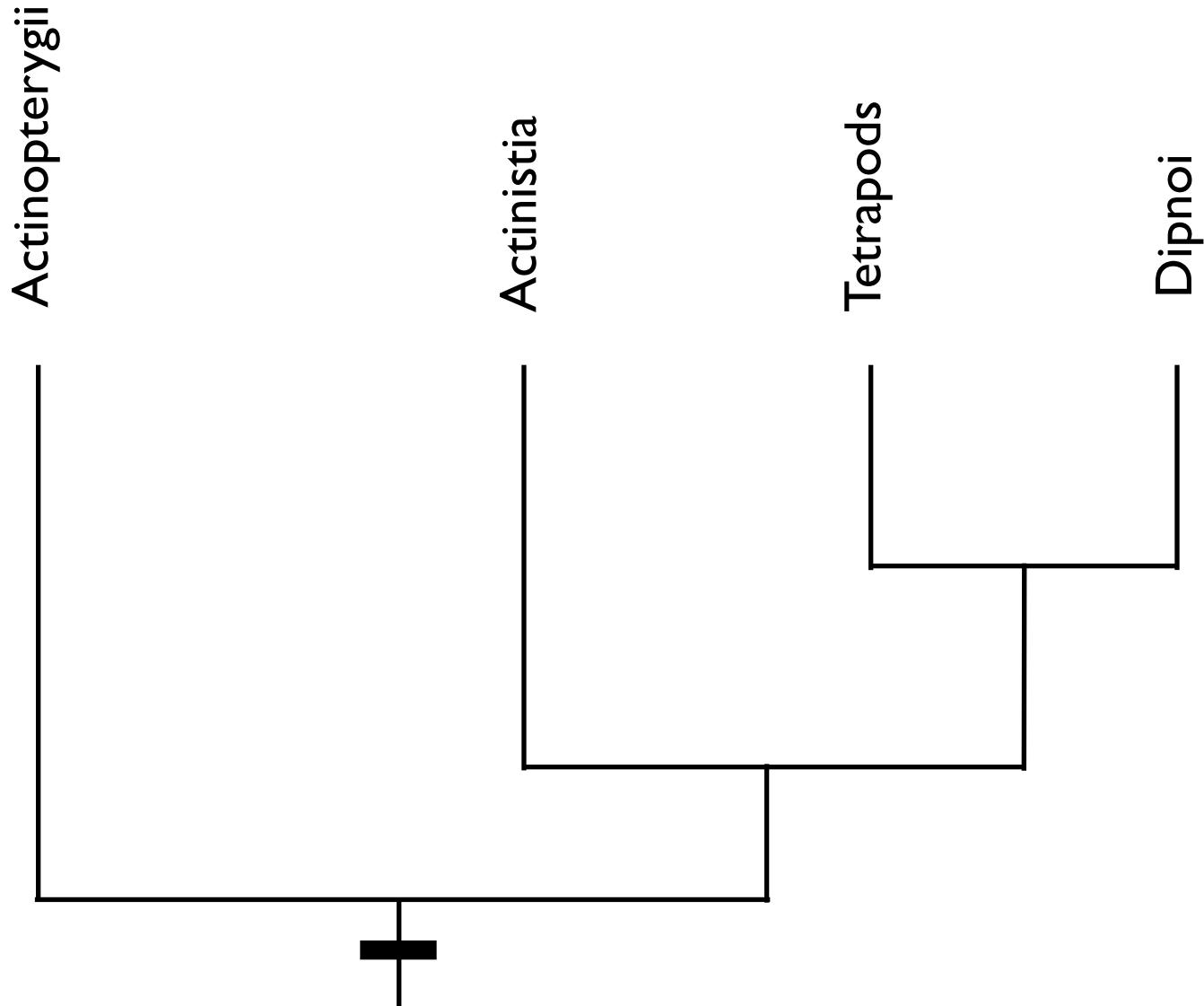
# Actinopterygii



ray-finned fishes

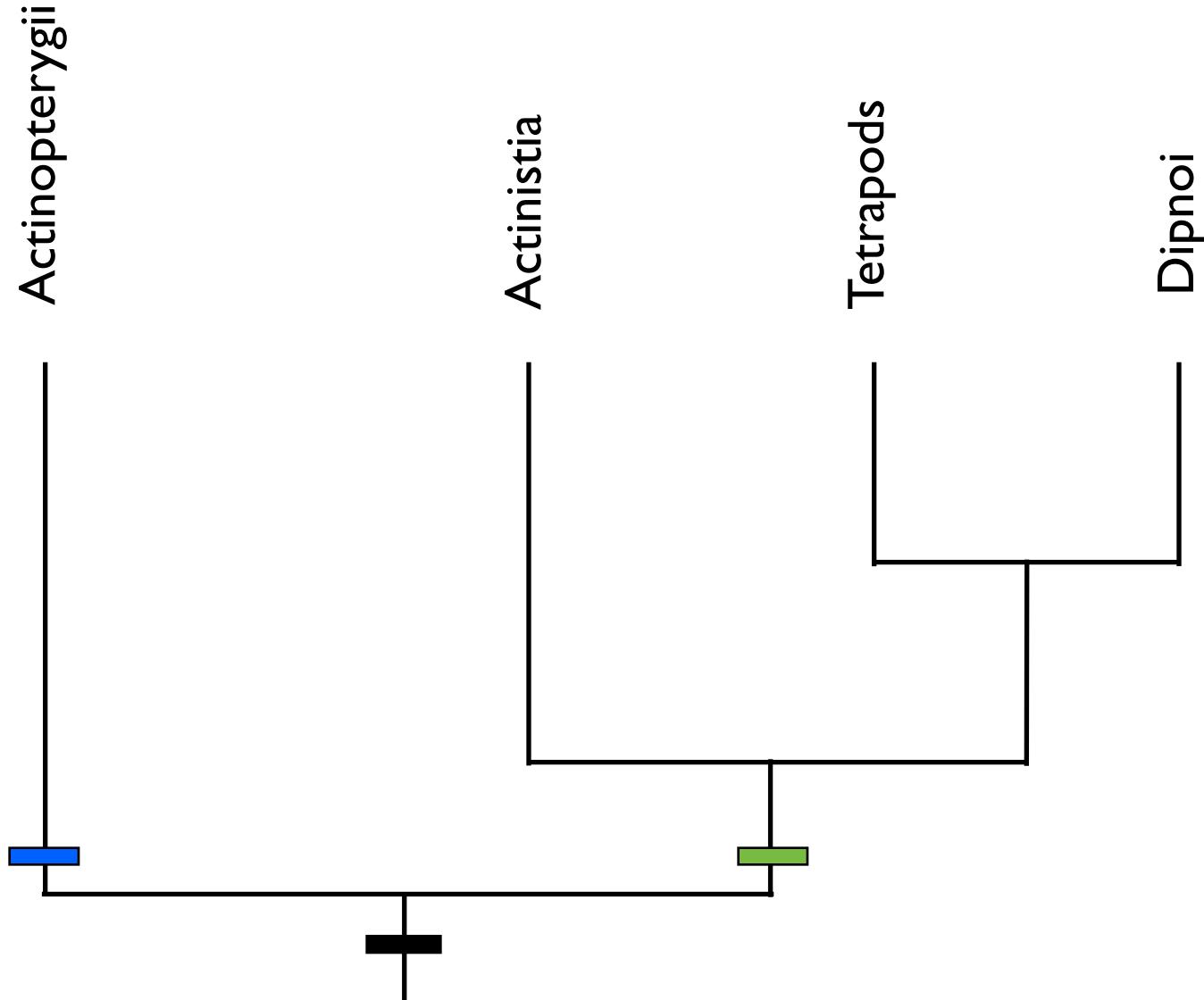


# Osteichthyes (bony fishes)



# Osteichthyes (bony fishes)

= Actinopterygii (ray-finned fishes) + Sarcopterygii (lobe-finned fishes)



Actinistia

92-73007A



Actinistia

92-73007A



Coelacanth

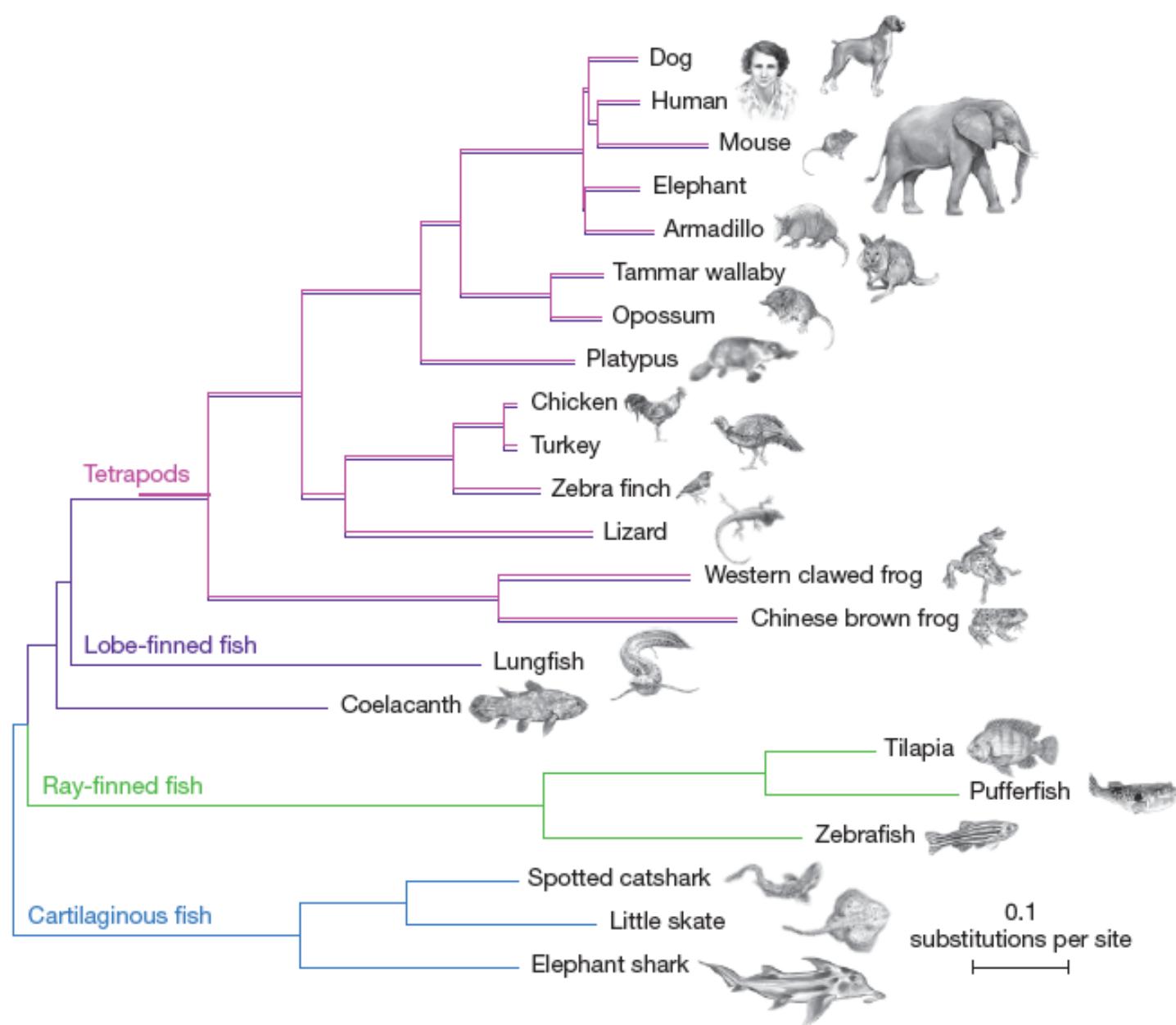




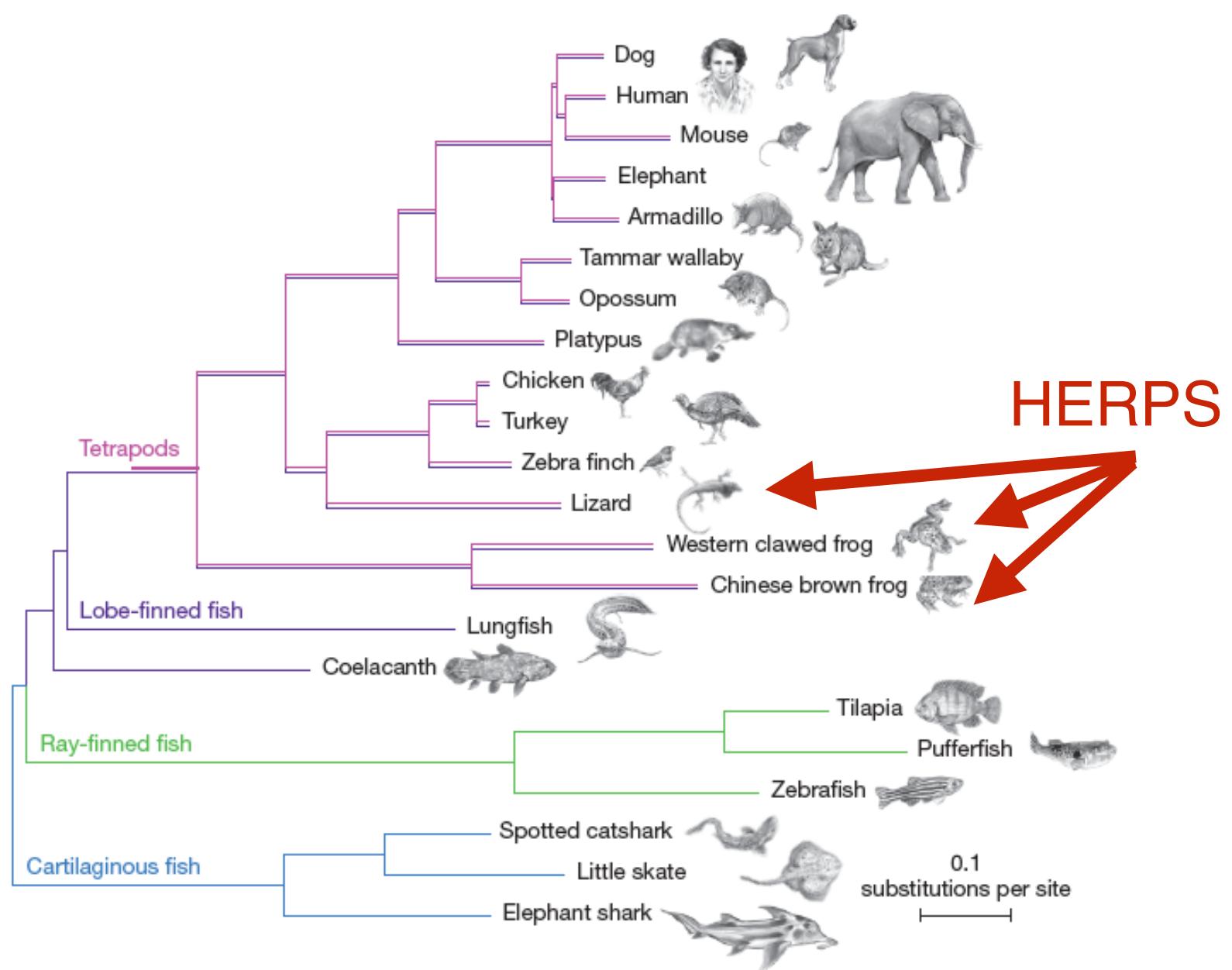
# Dipnoi



lungfish



**Figure 1 | A phylogenetic tree of a broad selection of jawed vertebrates shows that lungfish, not coelacanth, is the closest relative of tetrapods.**

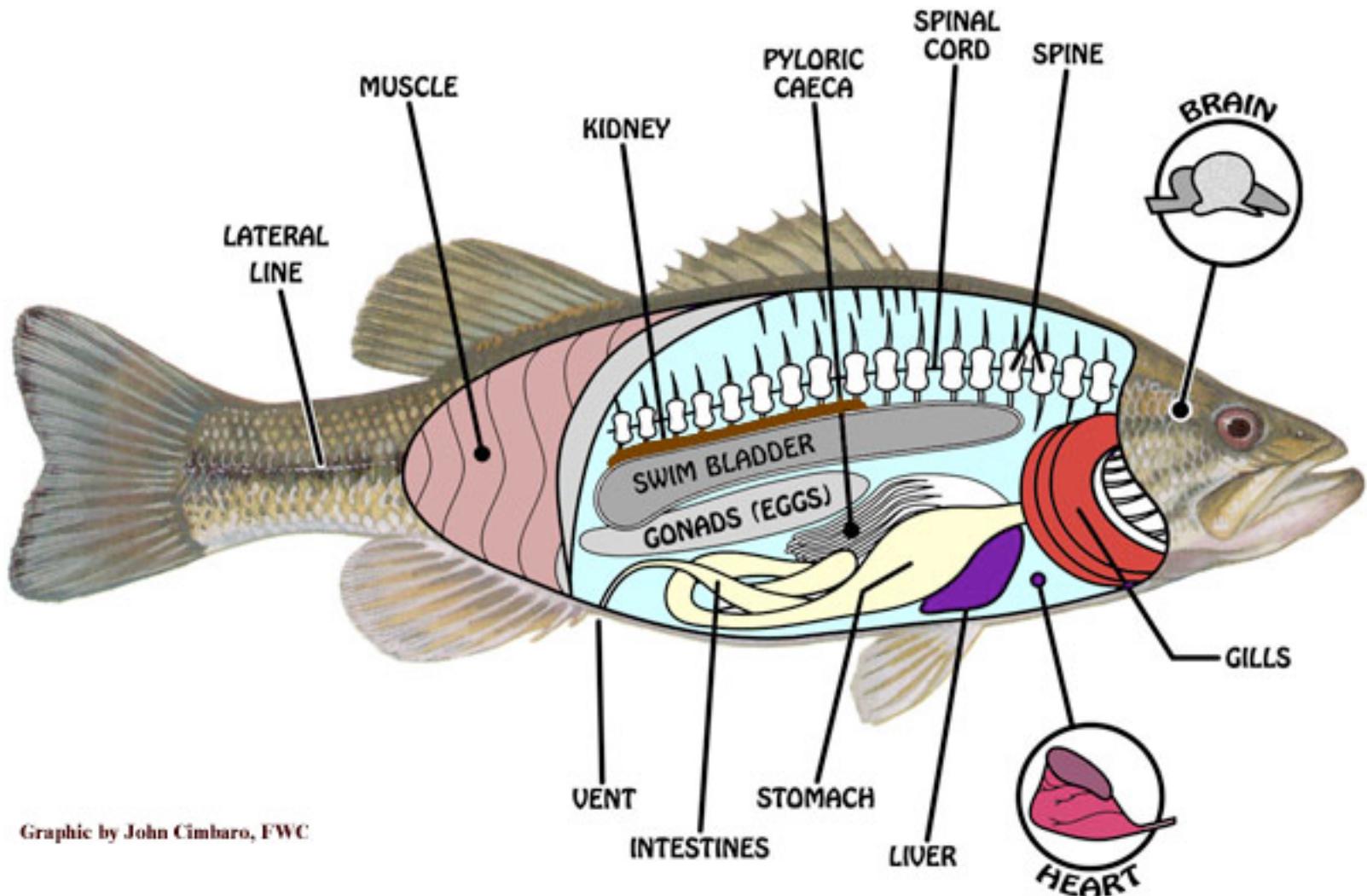


**Figure 1 |** A phylogenetic tree of a broad selection of jawed vertebrates shows that lungfish, not coelacanth, is the closest relative of tetrapods.

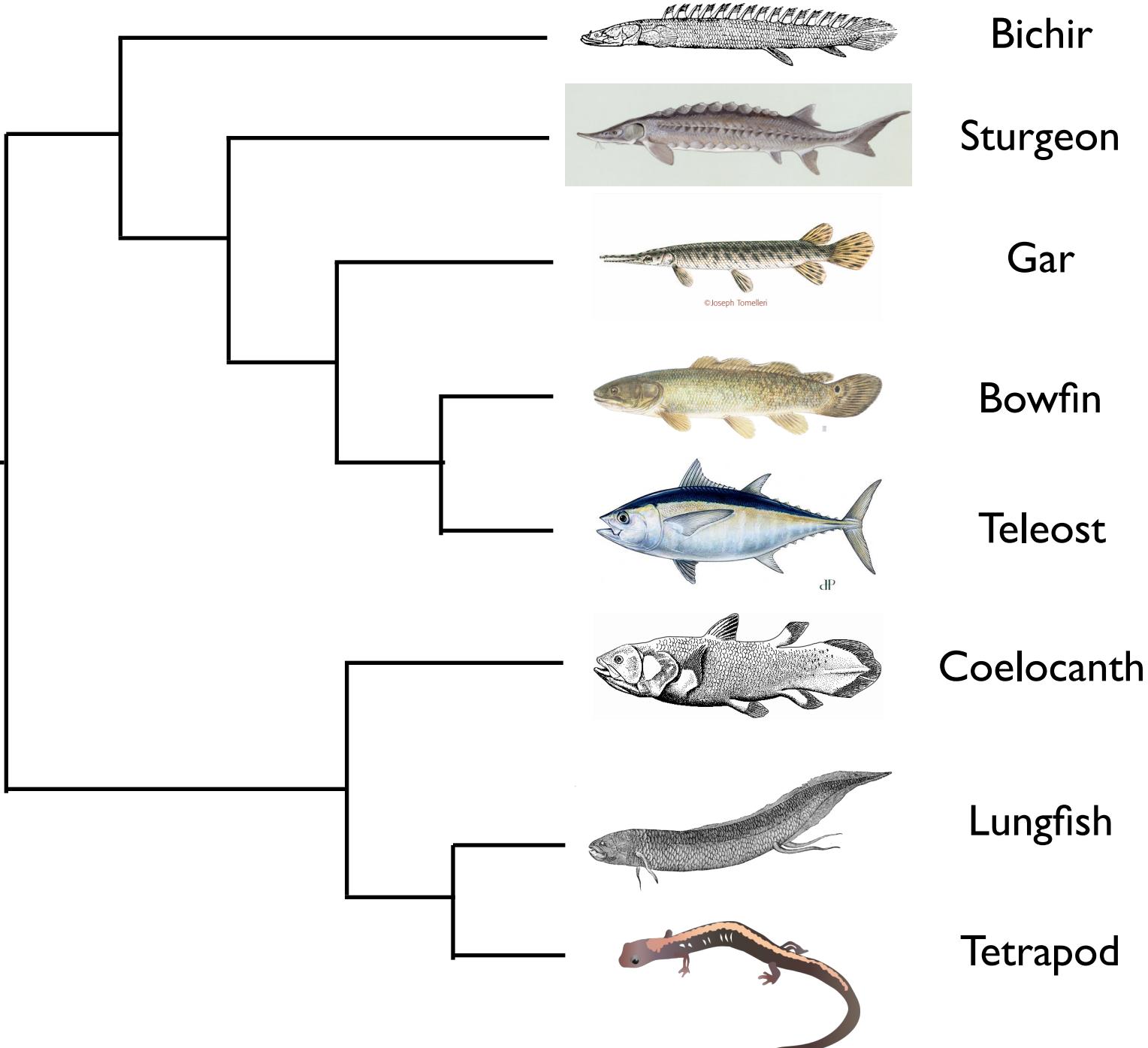
We can also use these phylogenetic trees to learn about the evolution of species' traits

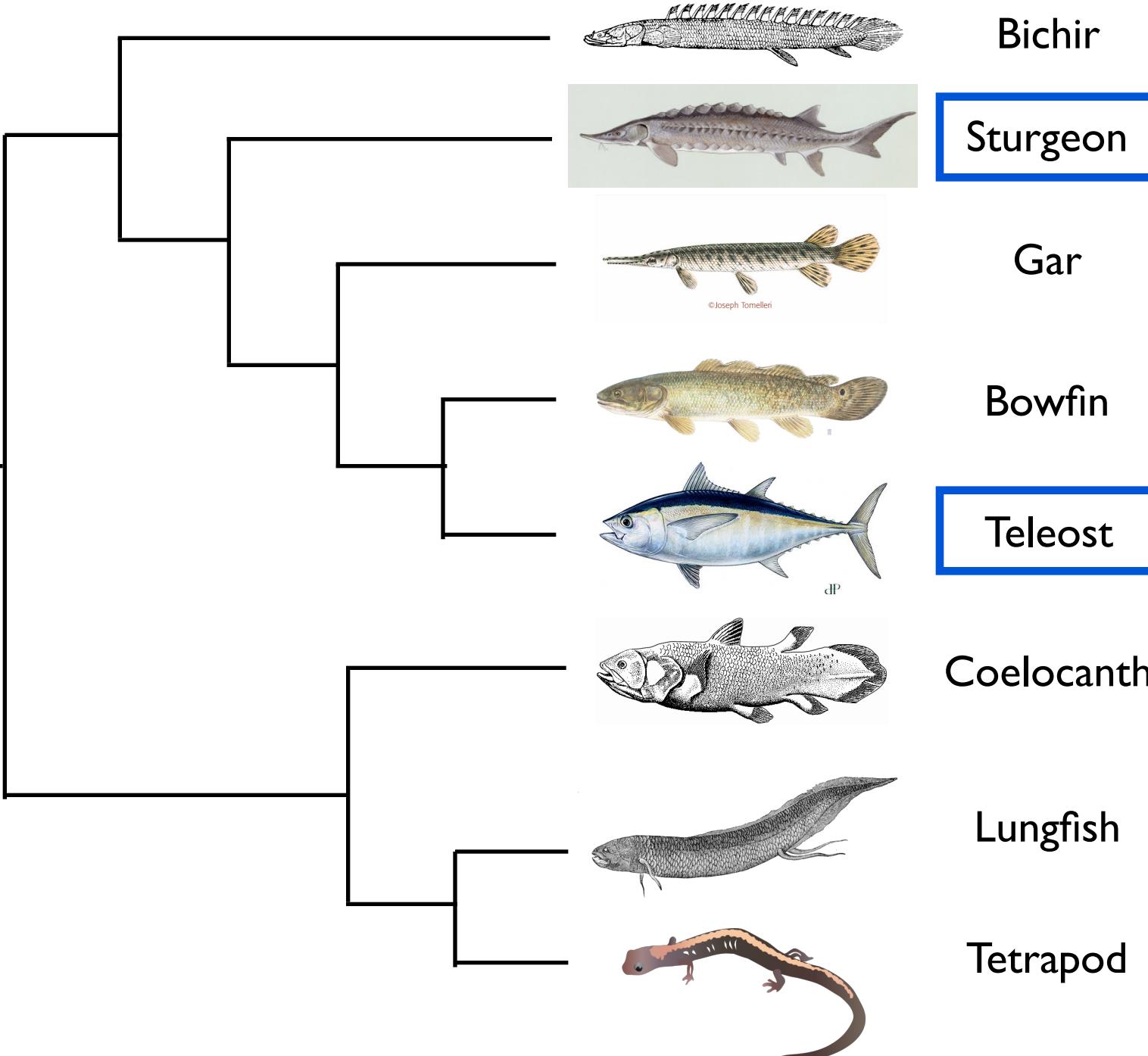


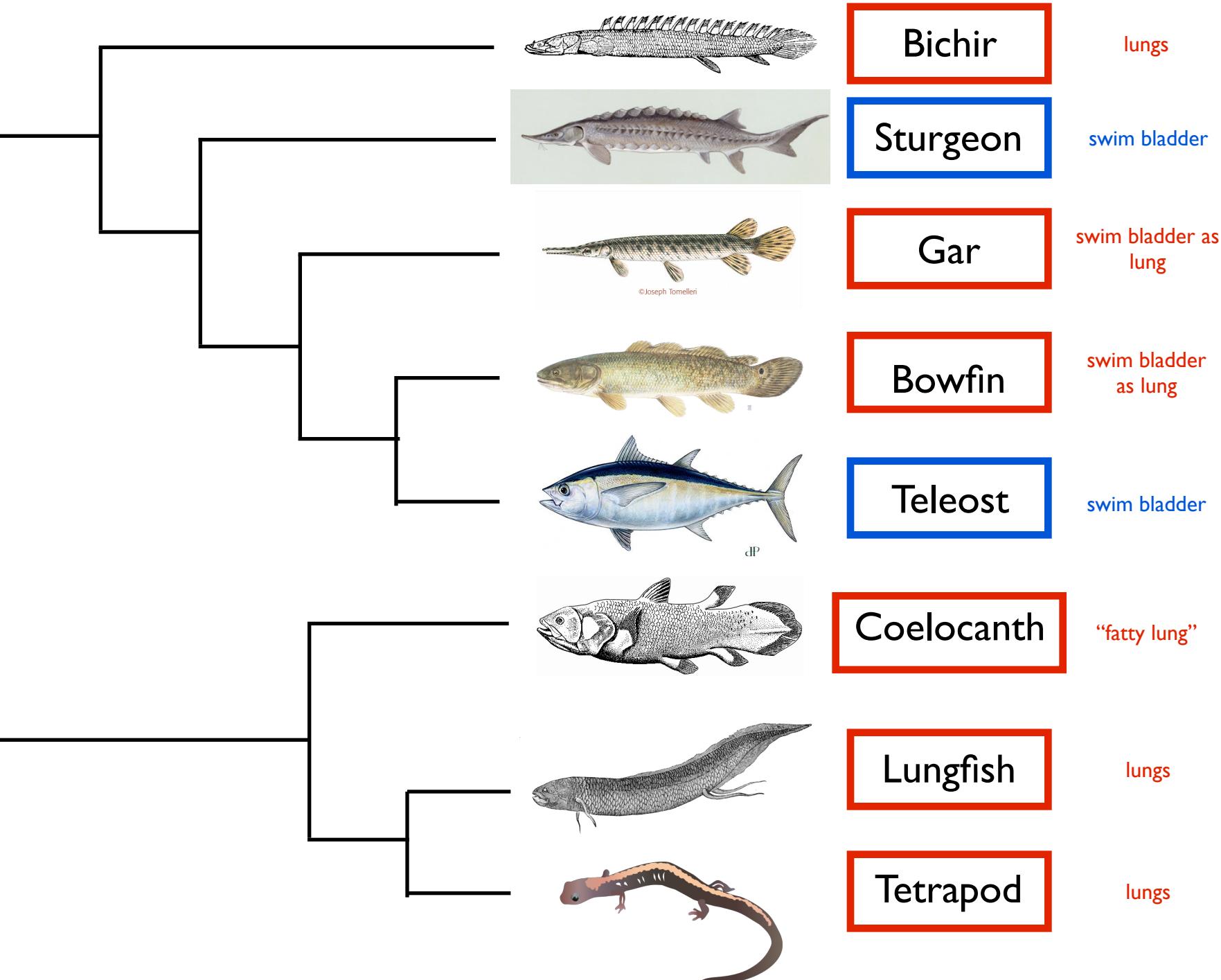


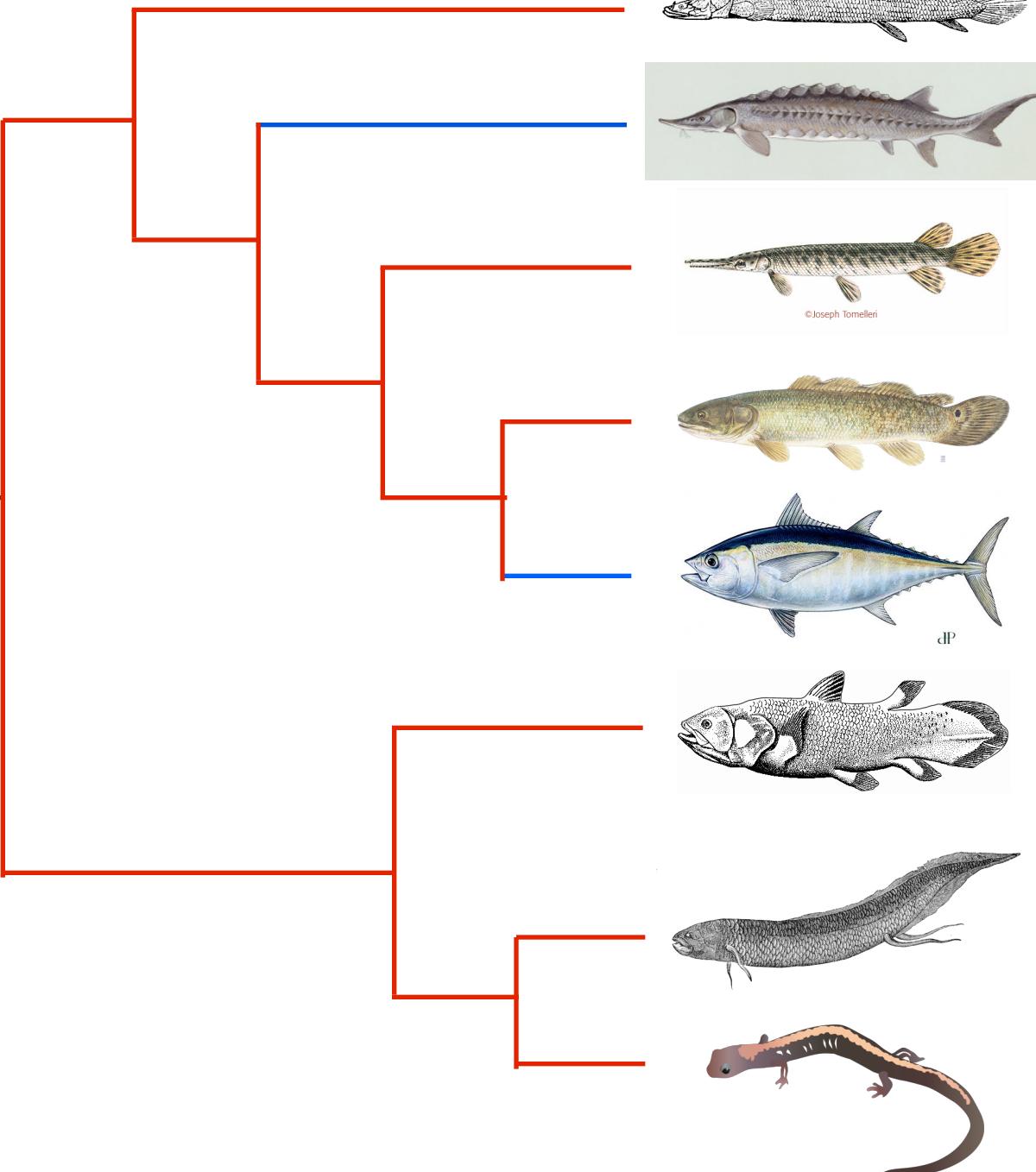


Graphic by John Cimbaro, FWC

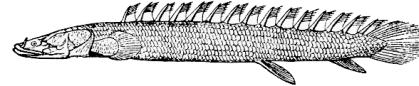
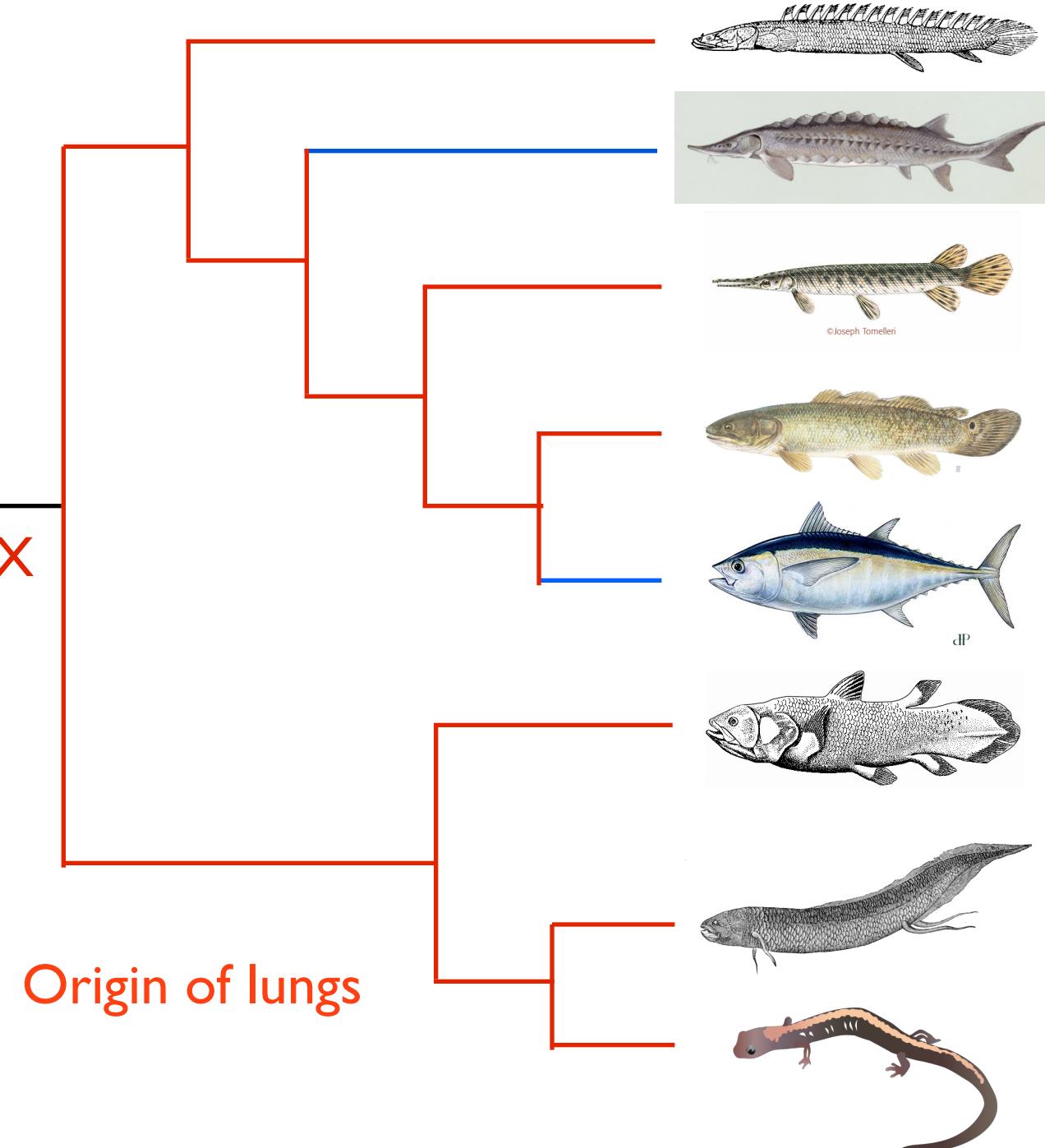




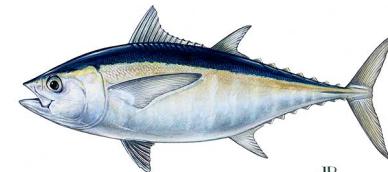




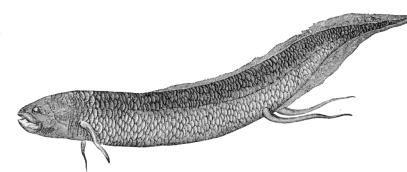
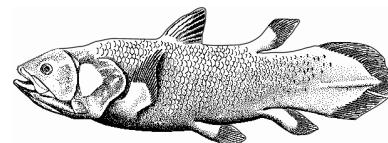
Origin of lungs



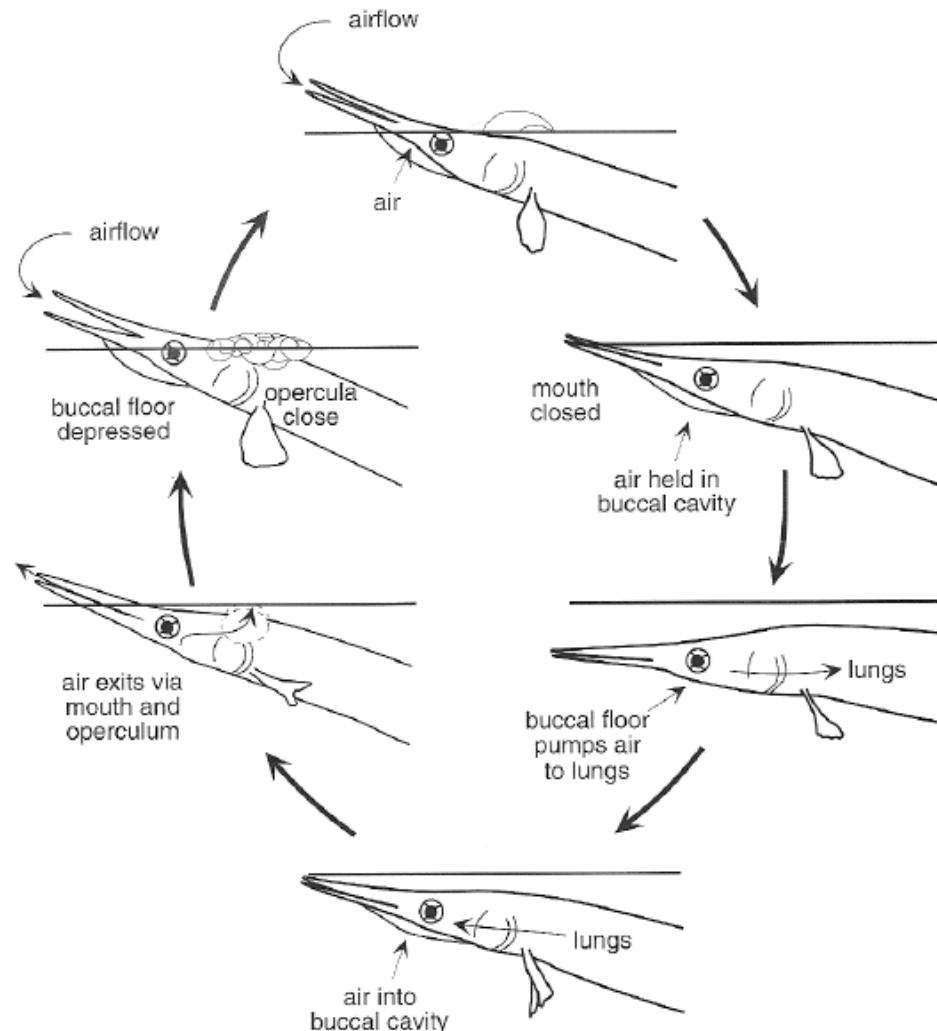
©Joseph Tomelleri



dp



# Lungs in the Water



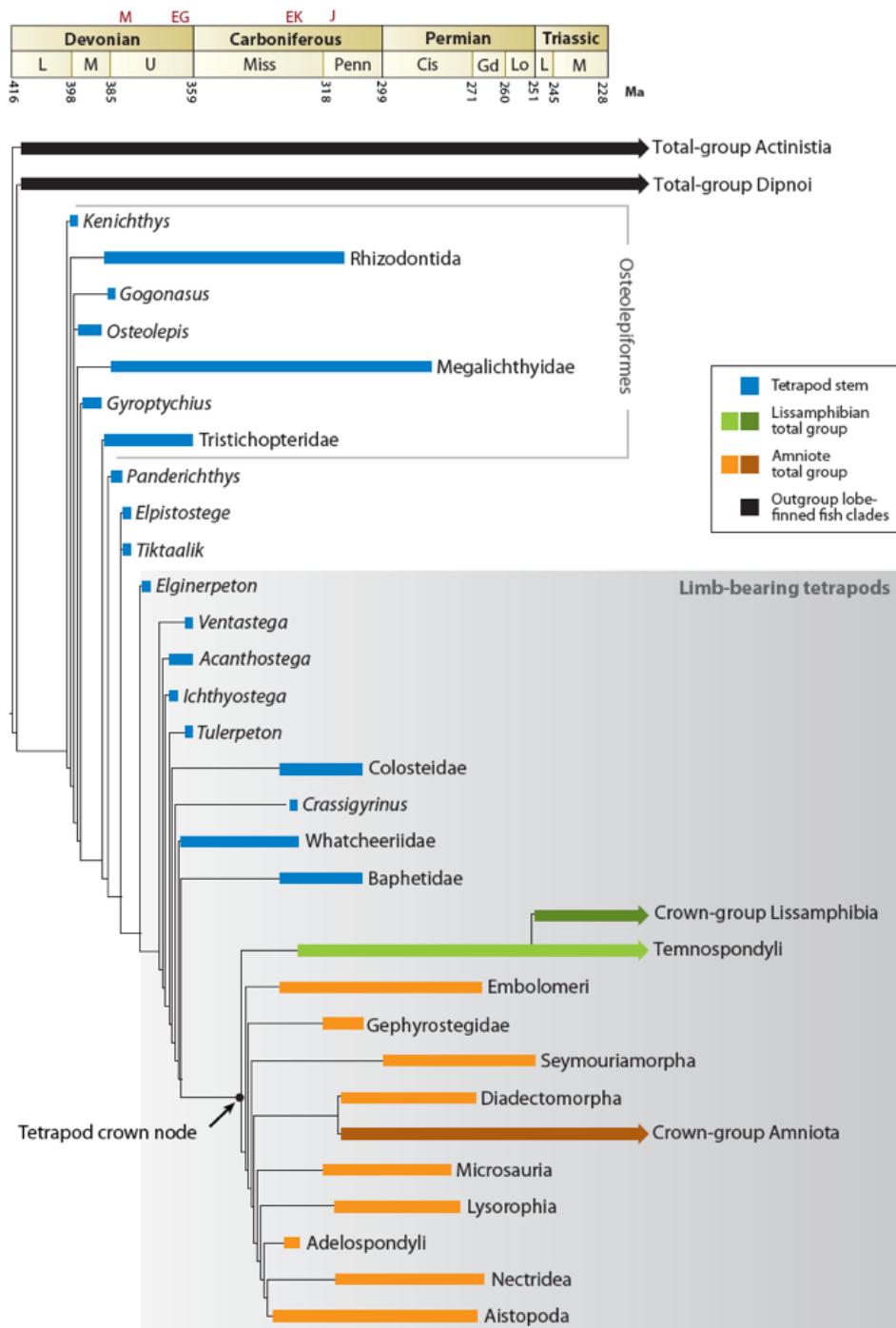
Air breathing cycle in the long-nosed Gar; from Zar et al.

**Conclusion:** lungs evolved in something that we would call a “fish” and were inherited by both reptiles and amphibians from a common ancestor

# How do we learn about the origin of herps?

- Study relationships among living species
- Find and analyze fossils

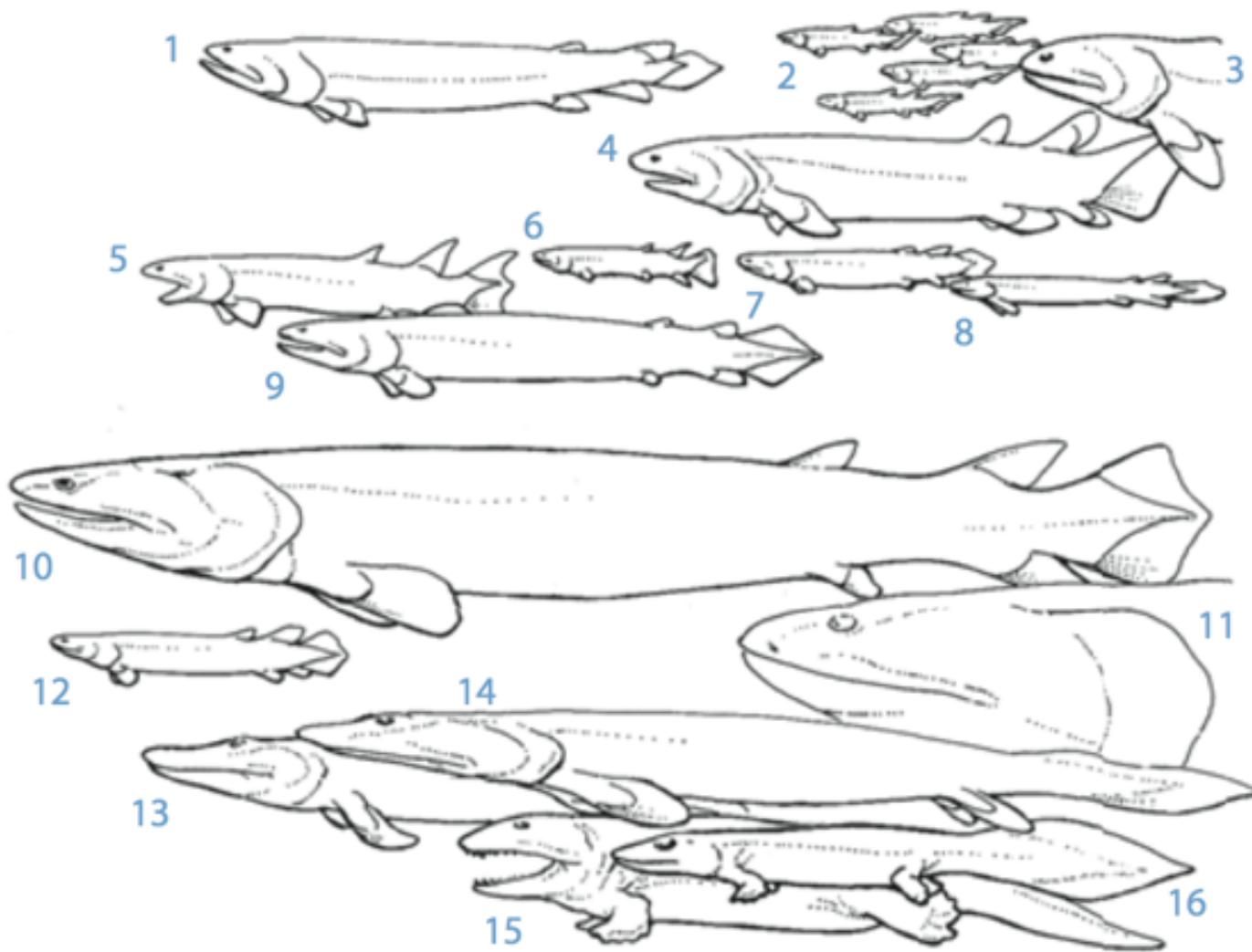




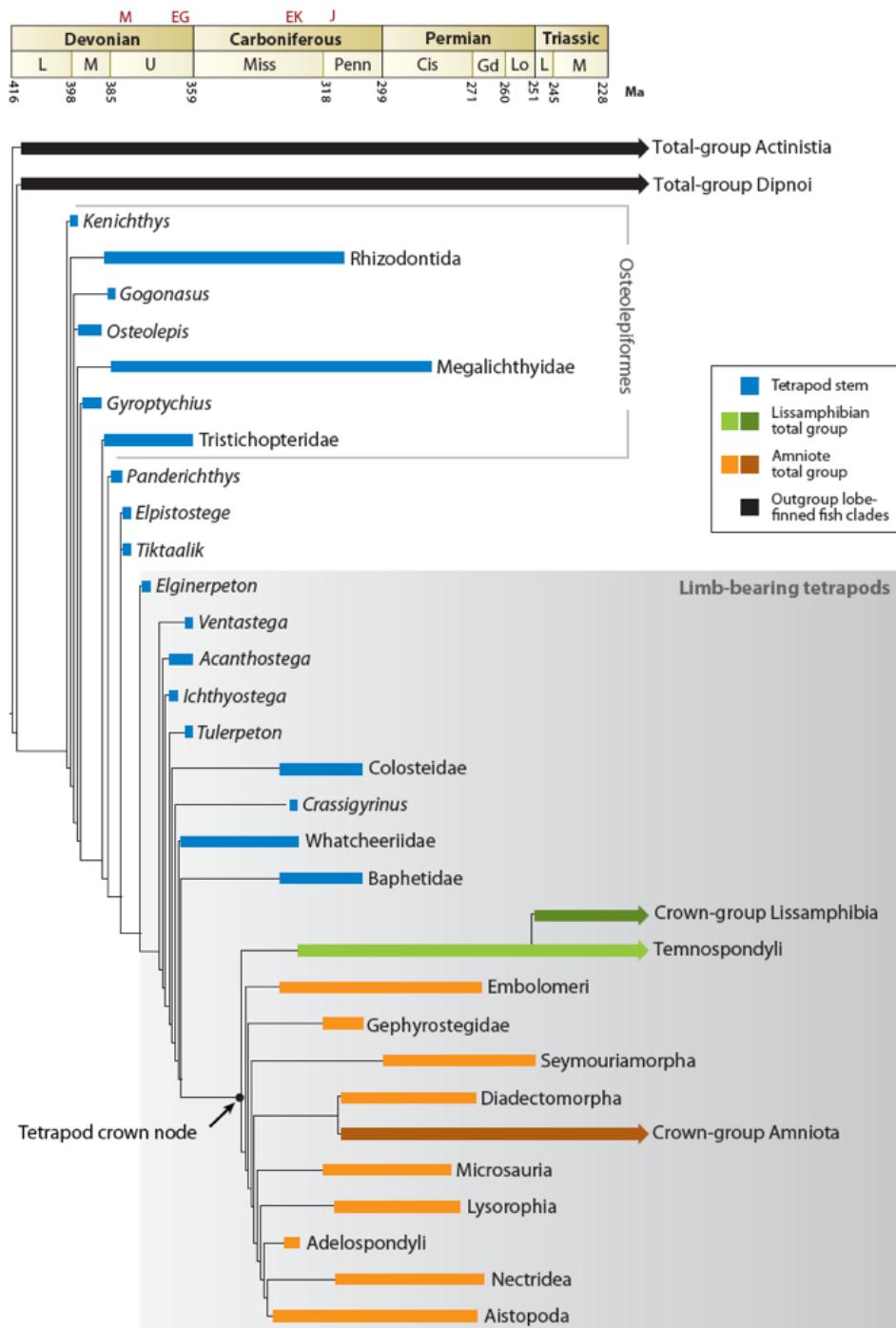
There are **hundreds of fossil taxa** that document the transition from lobe-finned fish, to tetrapods, and then to amphibians, reptiles, and mammals

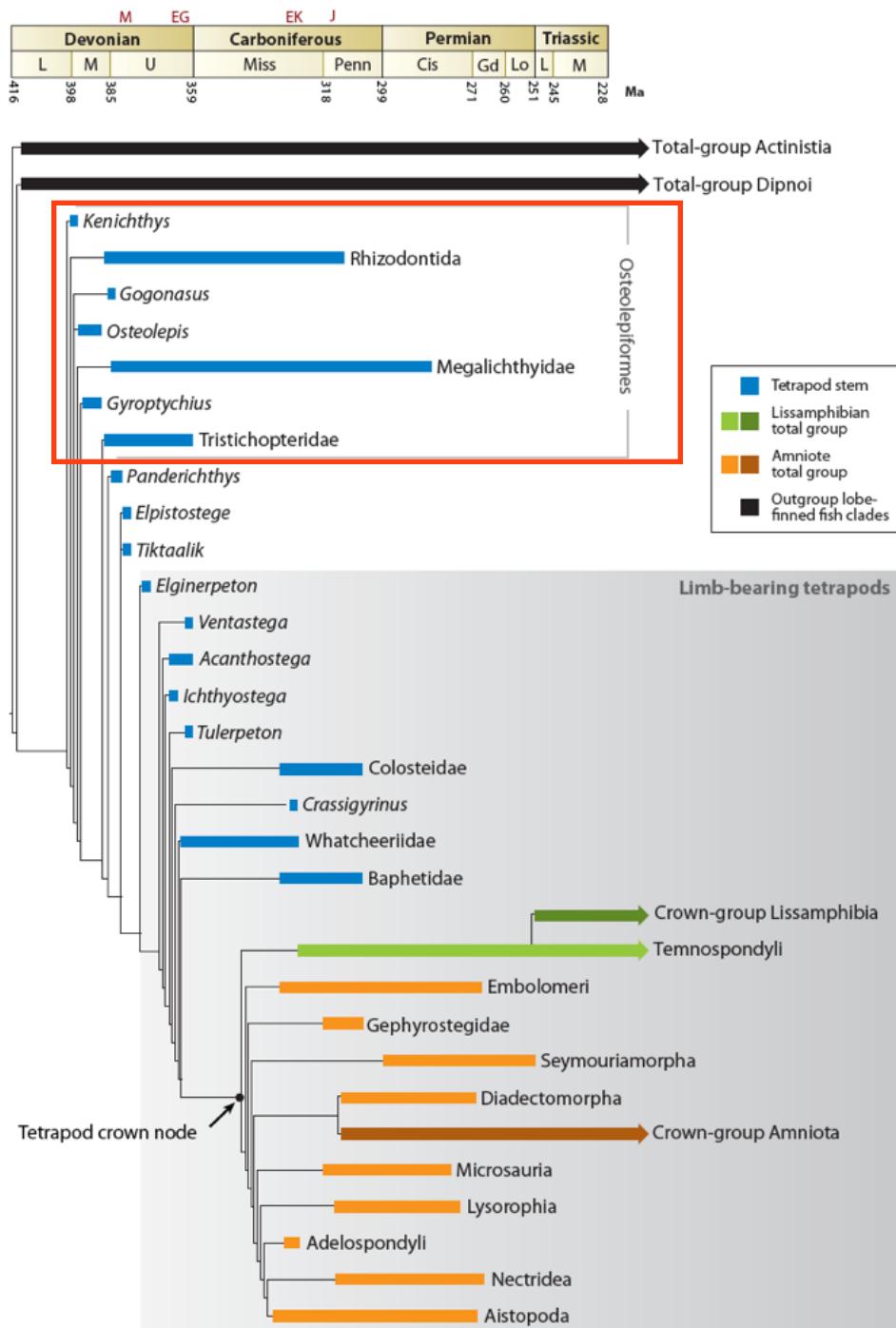
Lineages from the “tetrapod stem”  
tell the tale of the emergence of tetrapods

## Devonian tetrapods

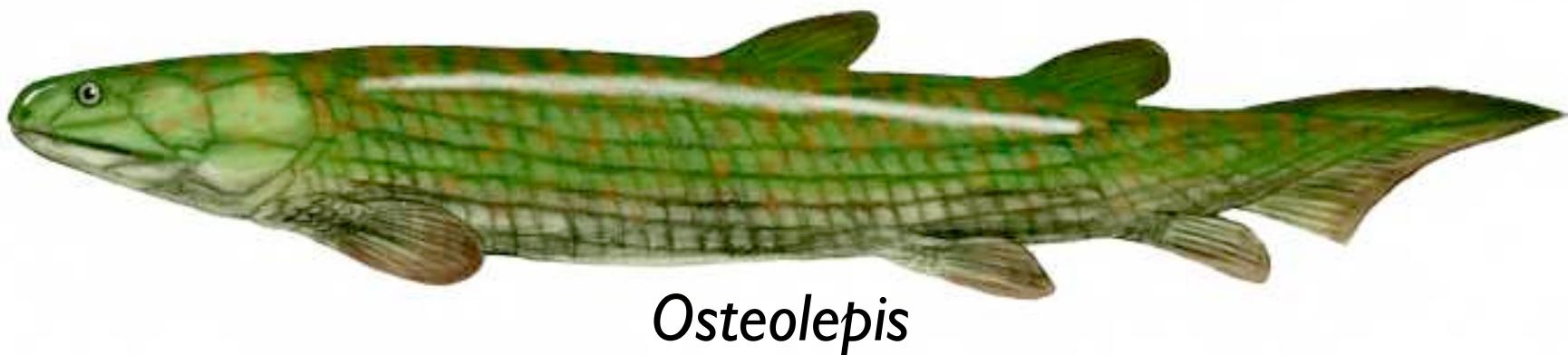


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# Osteolepiformes

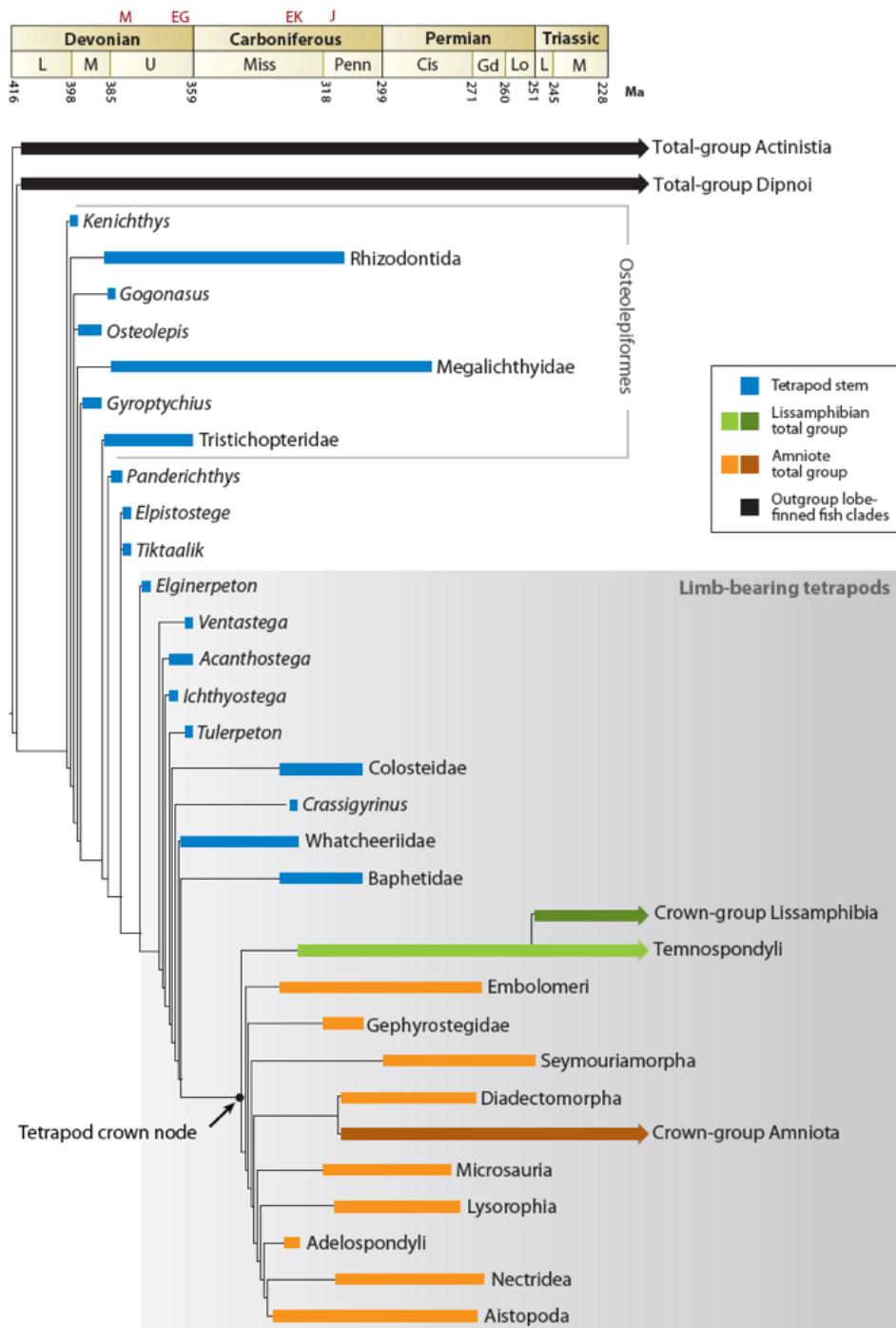


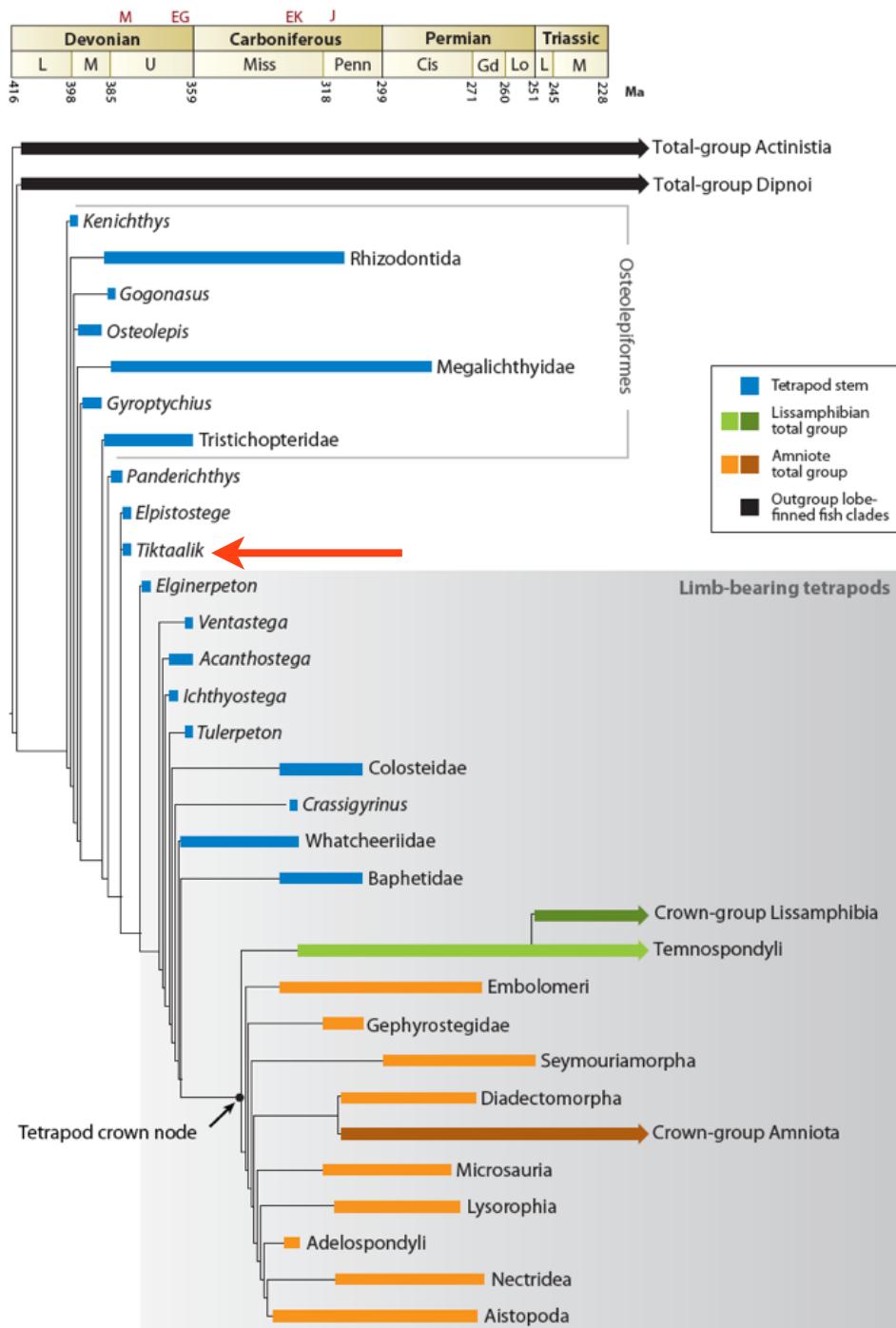
*Osteolepis*

ancient lobe-finned fishes



*Eusthenopteron*





# *Tiktaalik*





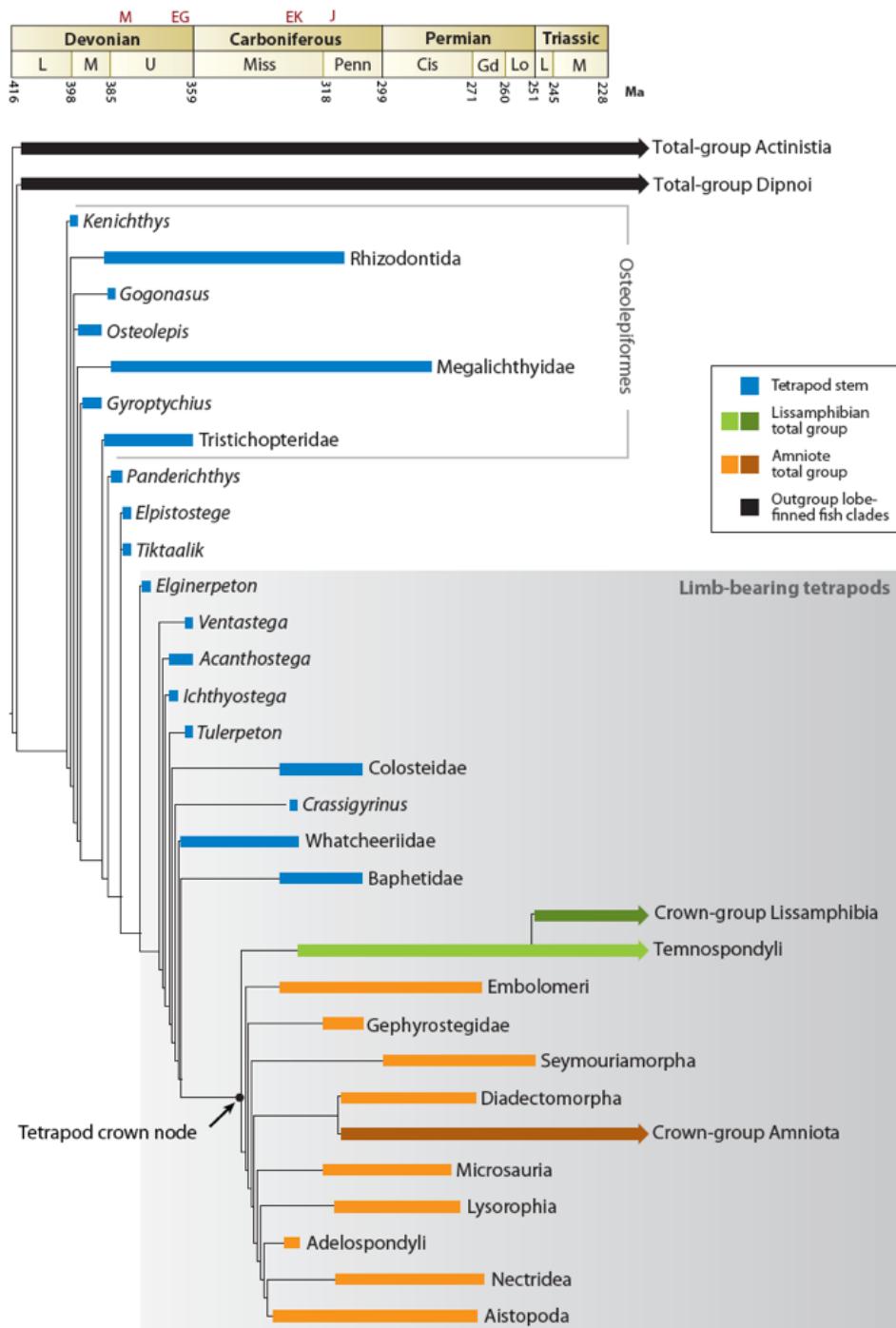
*Tiktaalik* could paddle & do push-ups...

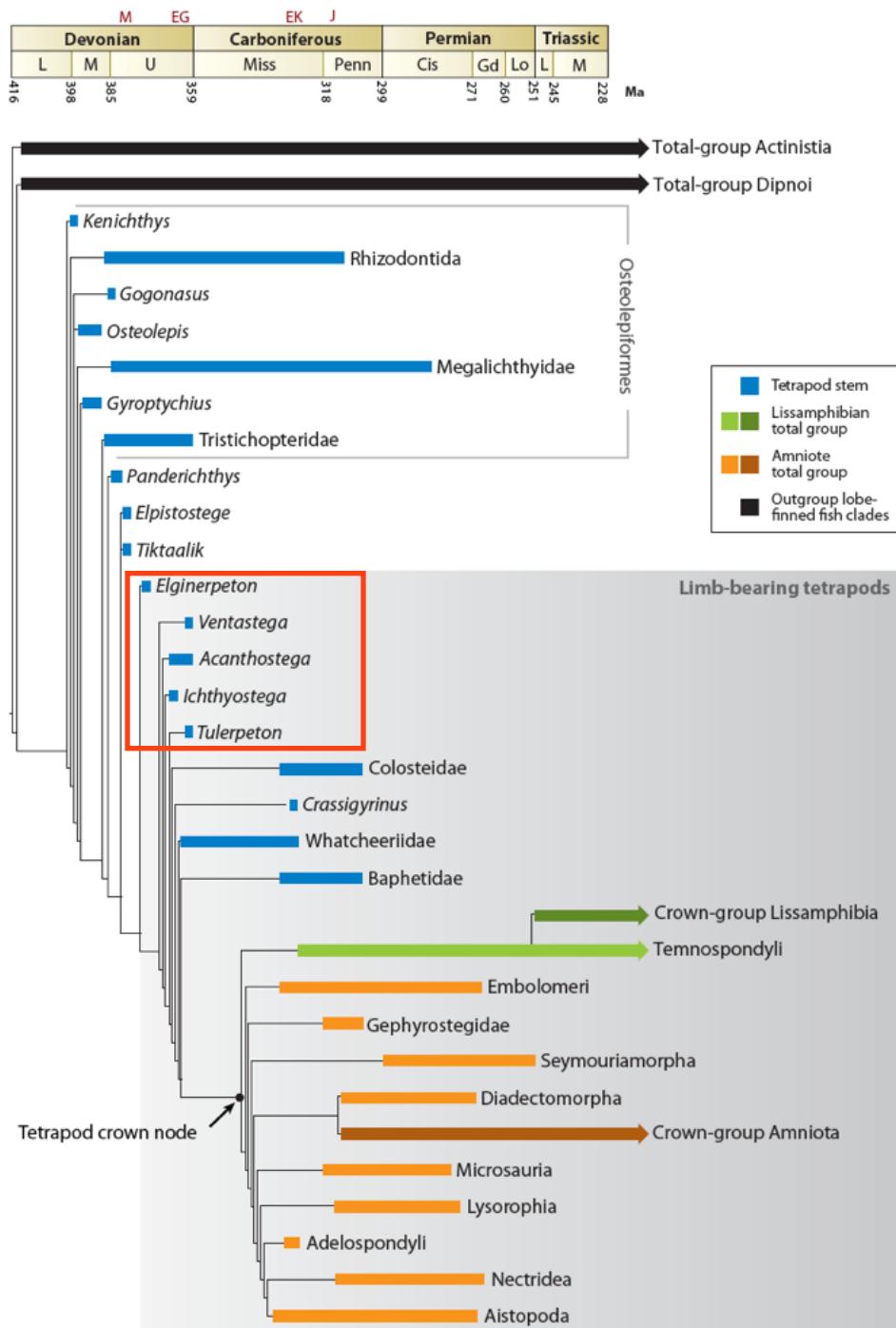
**Fin as a Paddle**



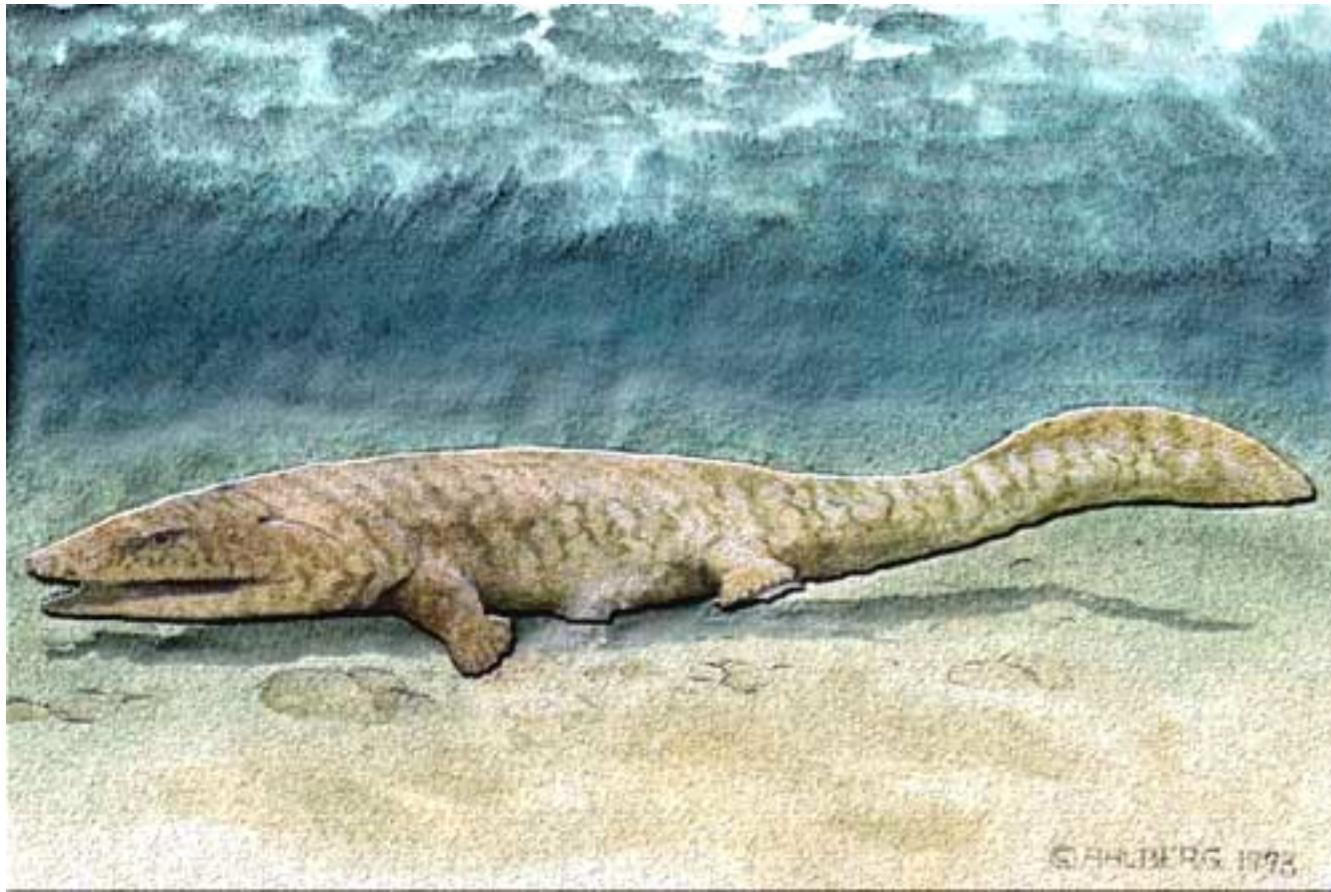
**Fin as a Prop**







early limb-bearing tetrapods



# *Elginerpeton*

- 370-364 mya
- Earliest known limbed tetrapod

Per Albergh

# *Acanthostega*



- 365 mya
- Best-known early tetrapod
- Limbs with 8 digits
- Aquatic

# *Acanthostega*



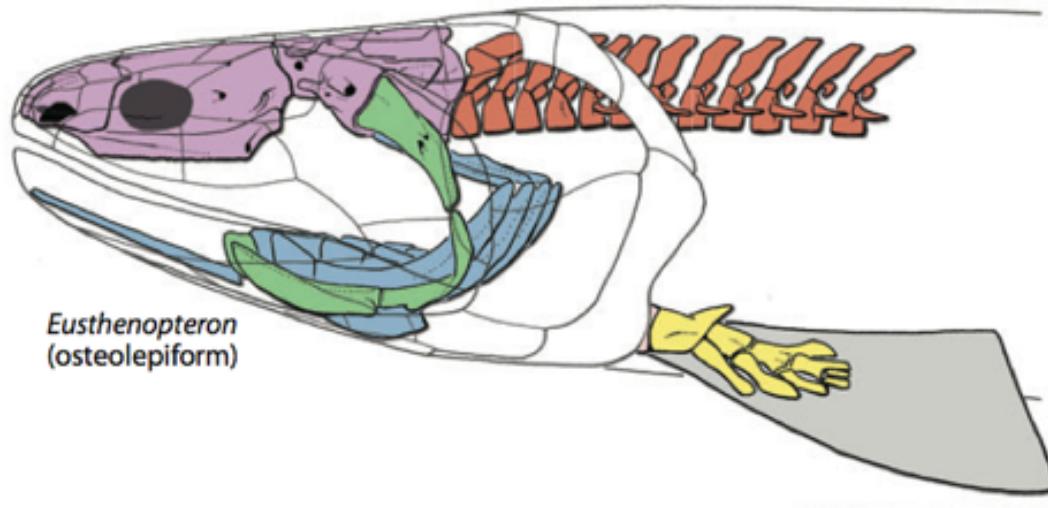
Picture from *Science*  
(Janice McCafferty)

# *Ichthyostega*

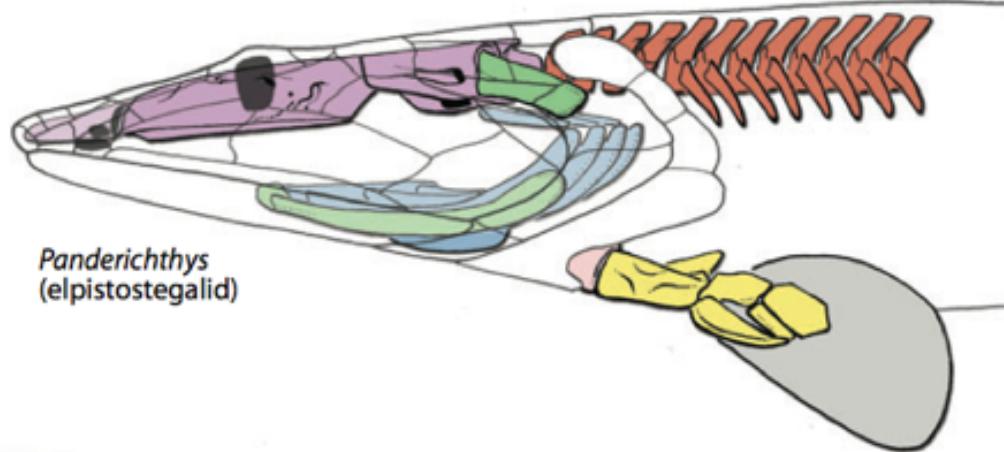


- 365 mya
- Limbs with 7 digits
- Fish-like tail but likely some ability to move on land

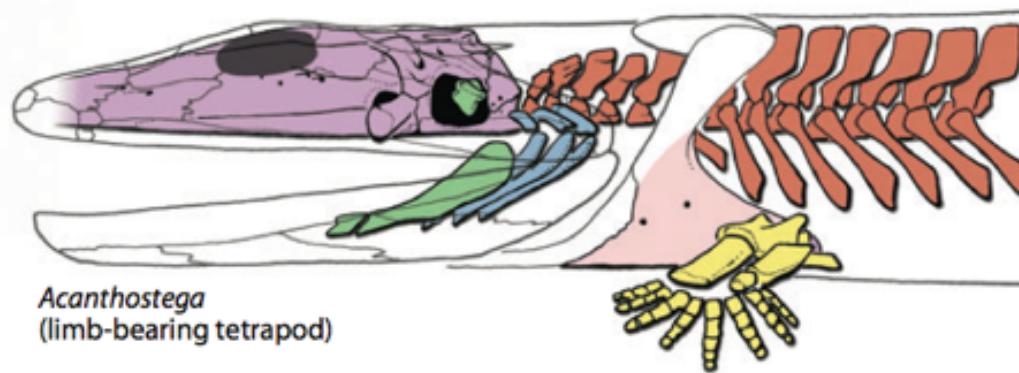
**All of these organisms had limbs but were aquatic!**



*Eusthenopteron*  
(osteolepiform)

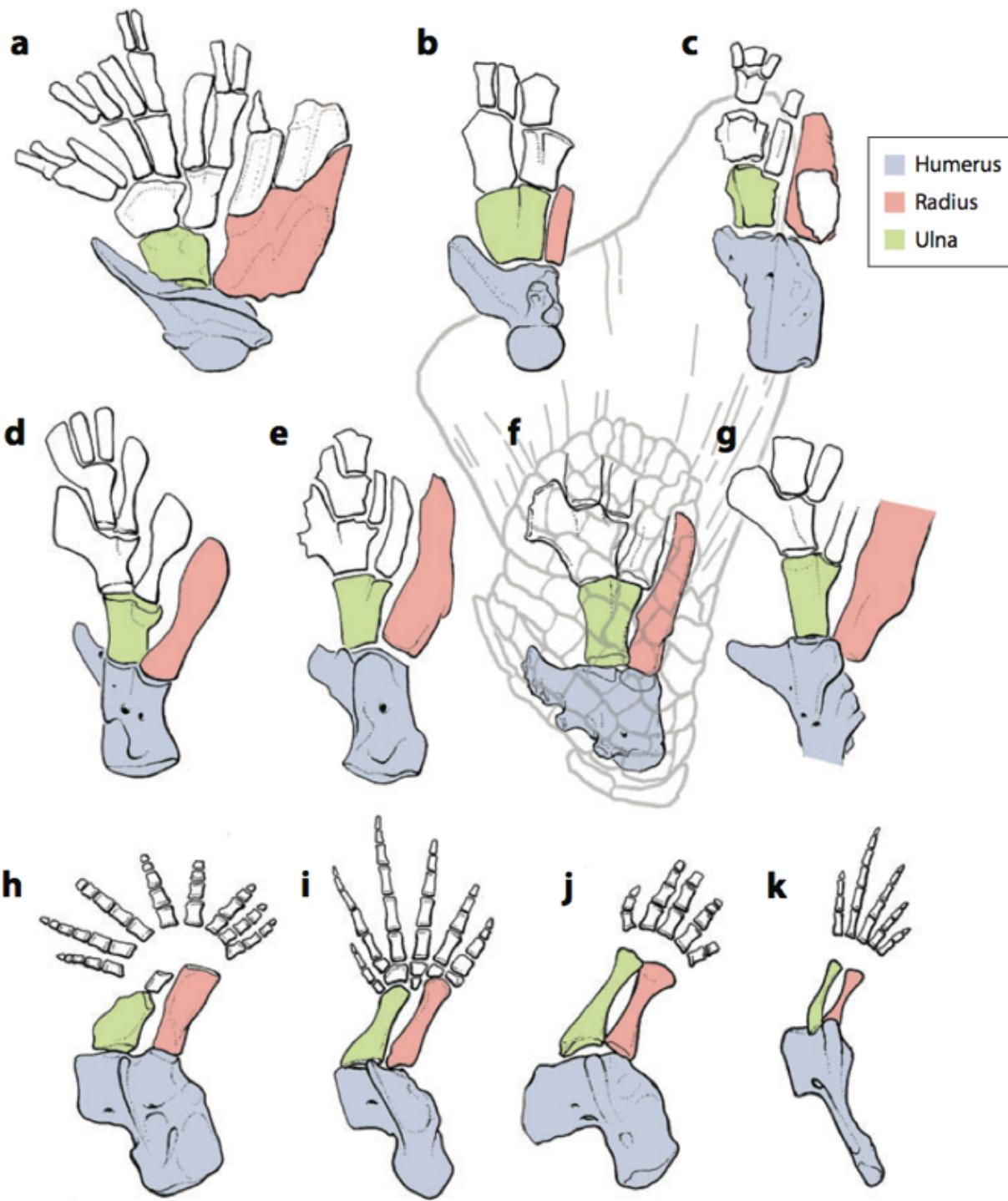


*Panderichthys*  
(elpistostegiid)



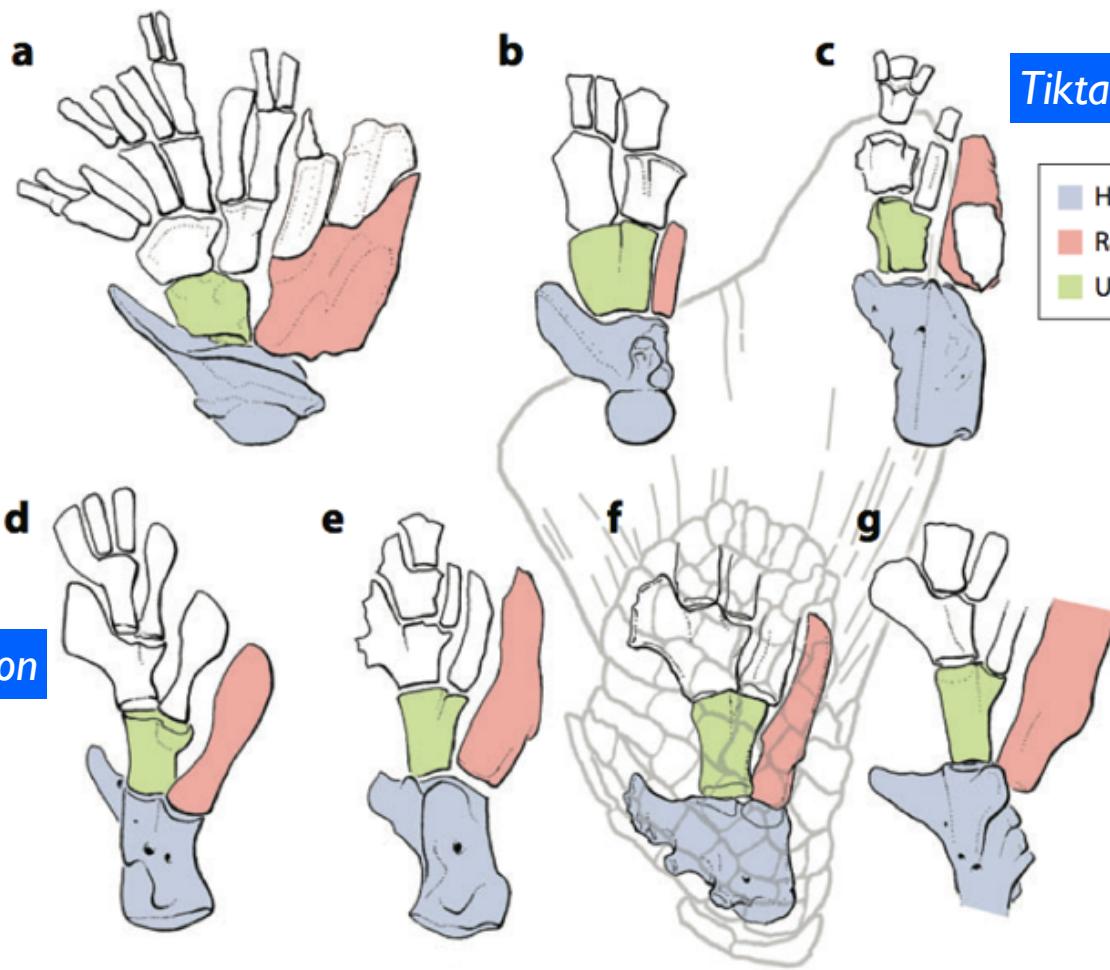
*Acanthostega*  
(limb-bearing tetrapod)

- Braincase
- Hyoid arch
- Gill arches
- Vertebral column
- Primary (endoskeletal) pectoral girdle
- Primary (endoskeletal) pectoral fin/ forelimb
- Finweb (dermal skeletal)

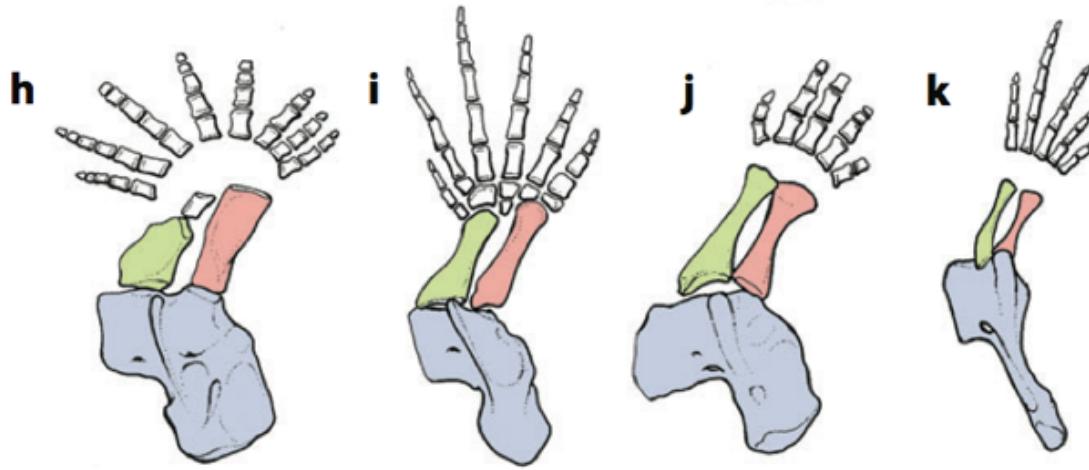


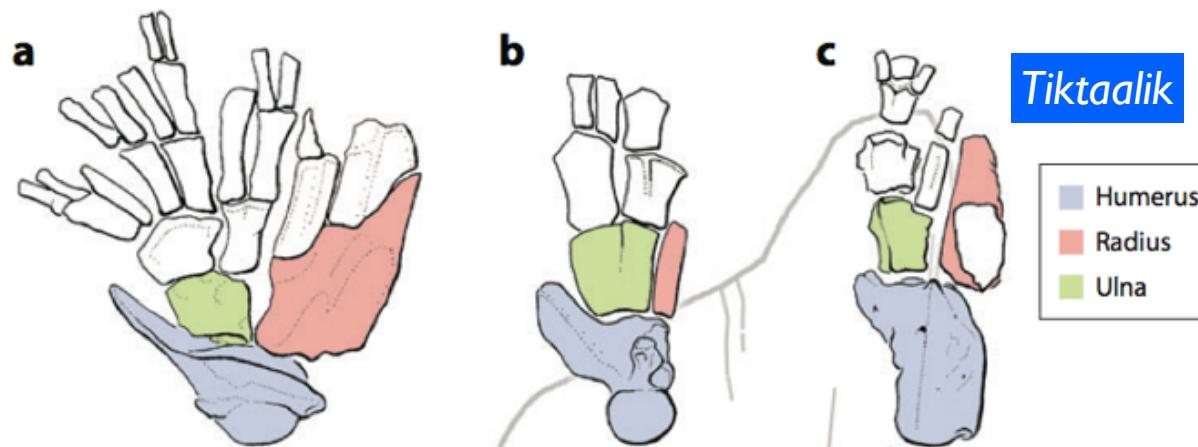
Tiktaalik

Humerus  
Radius  
Ulna

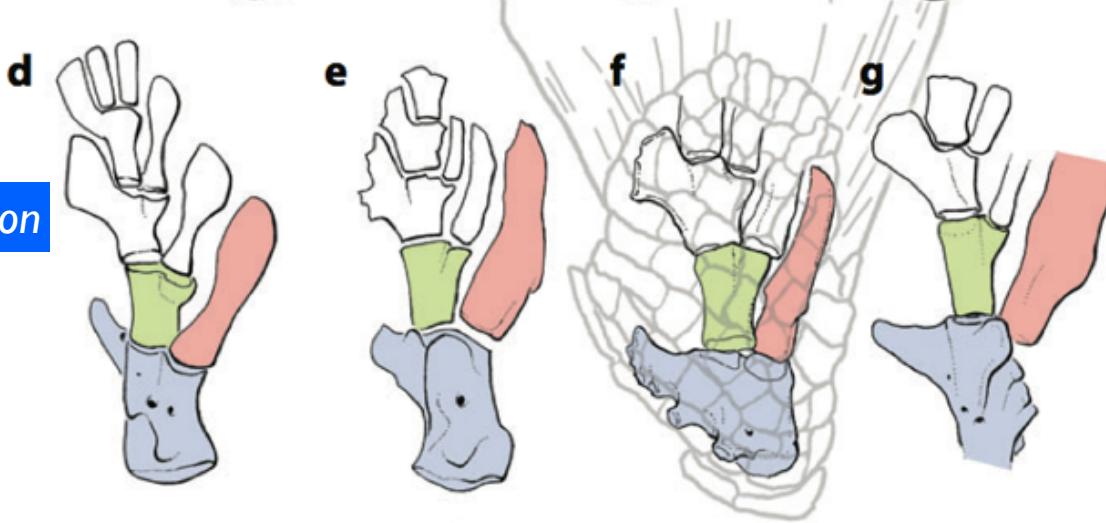


Eusthenopteron

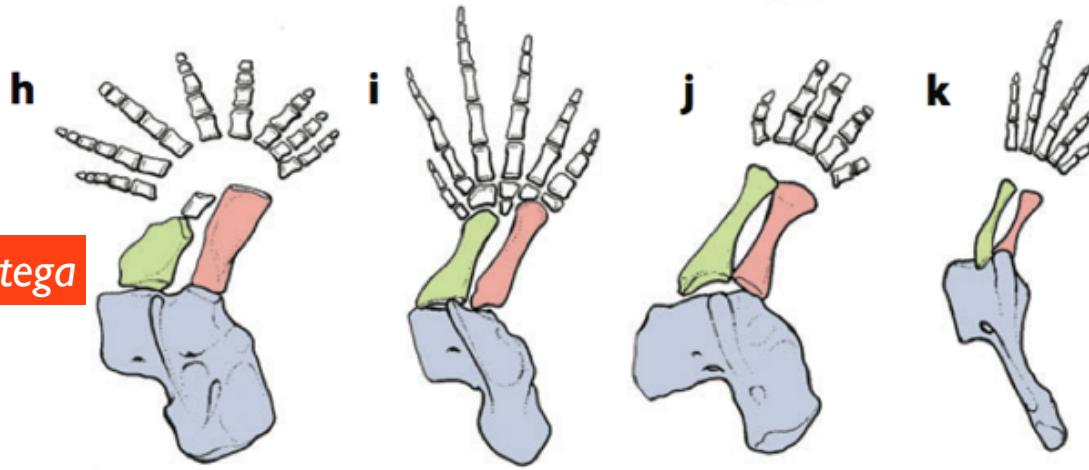




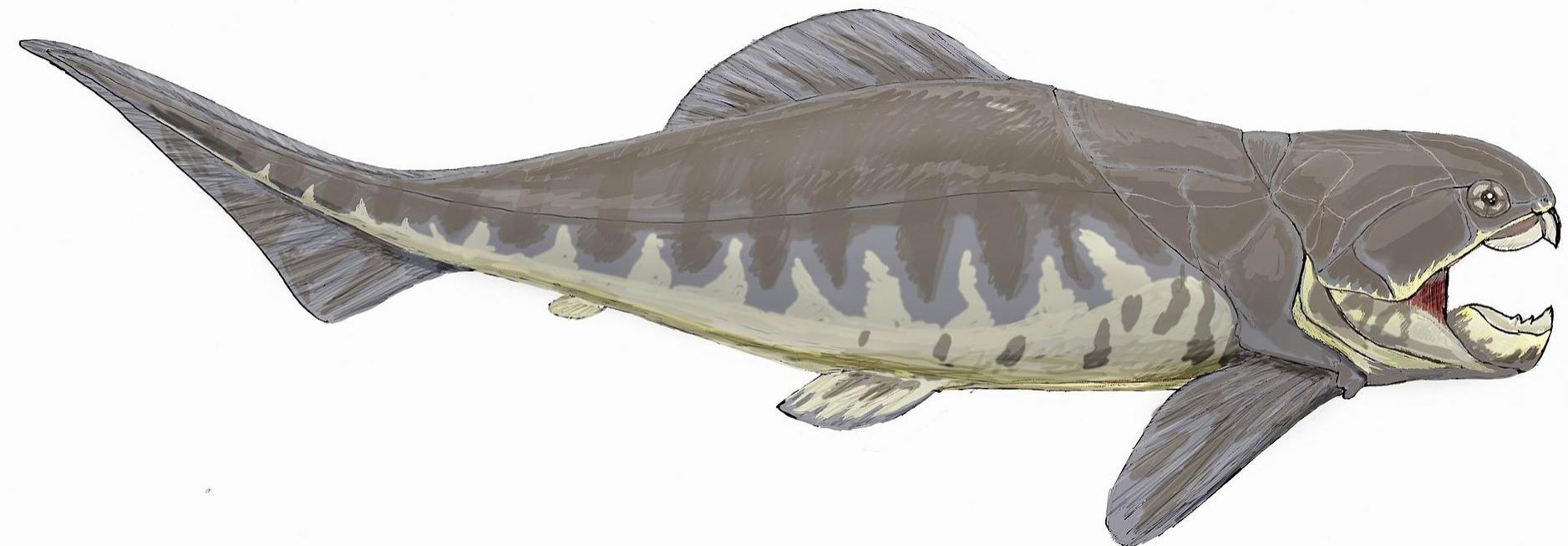
**Eusthenopteron**



**Acanthostega**

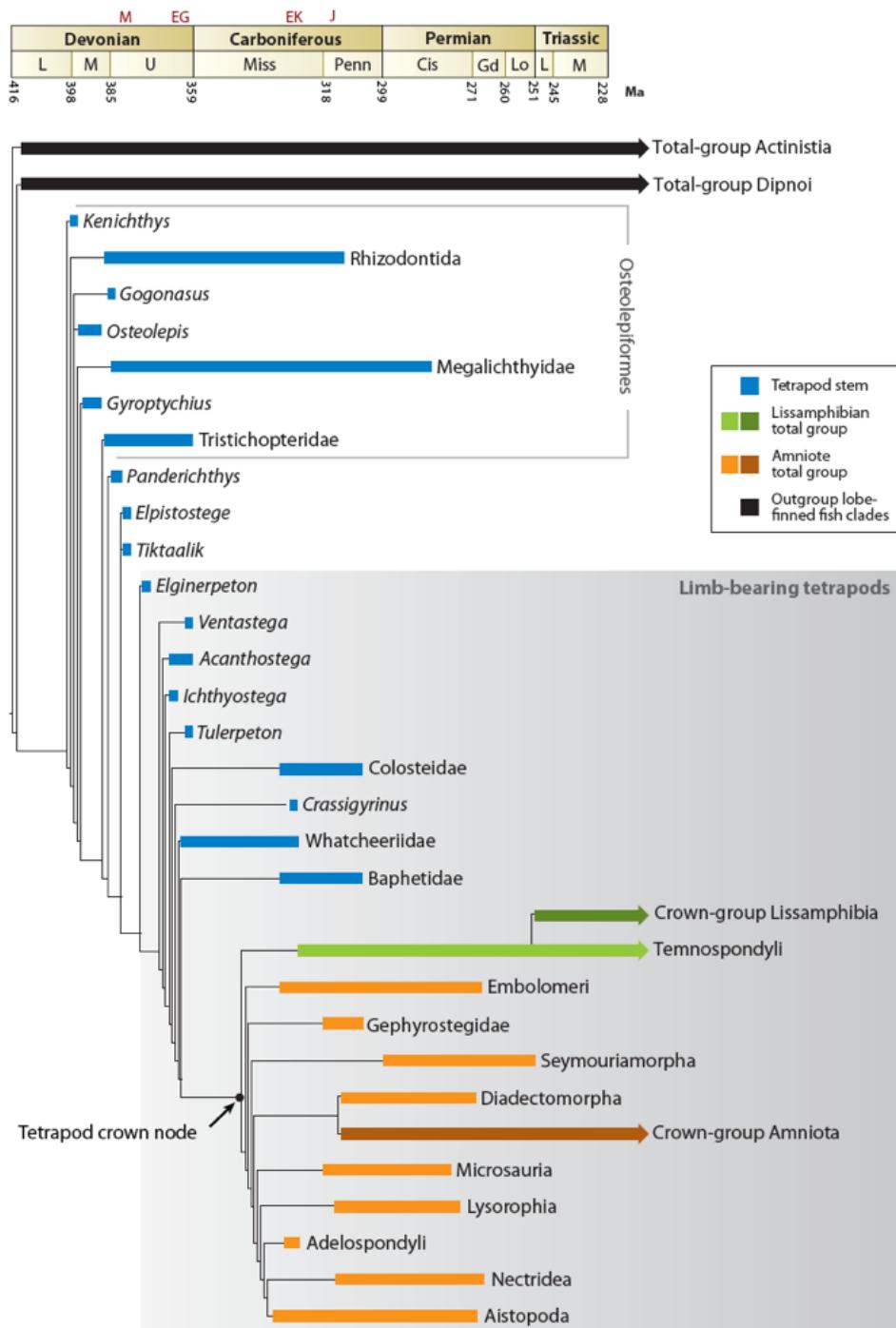


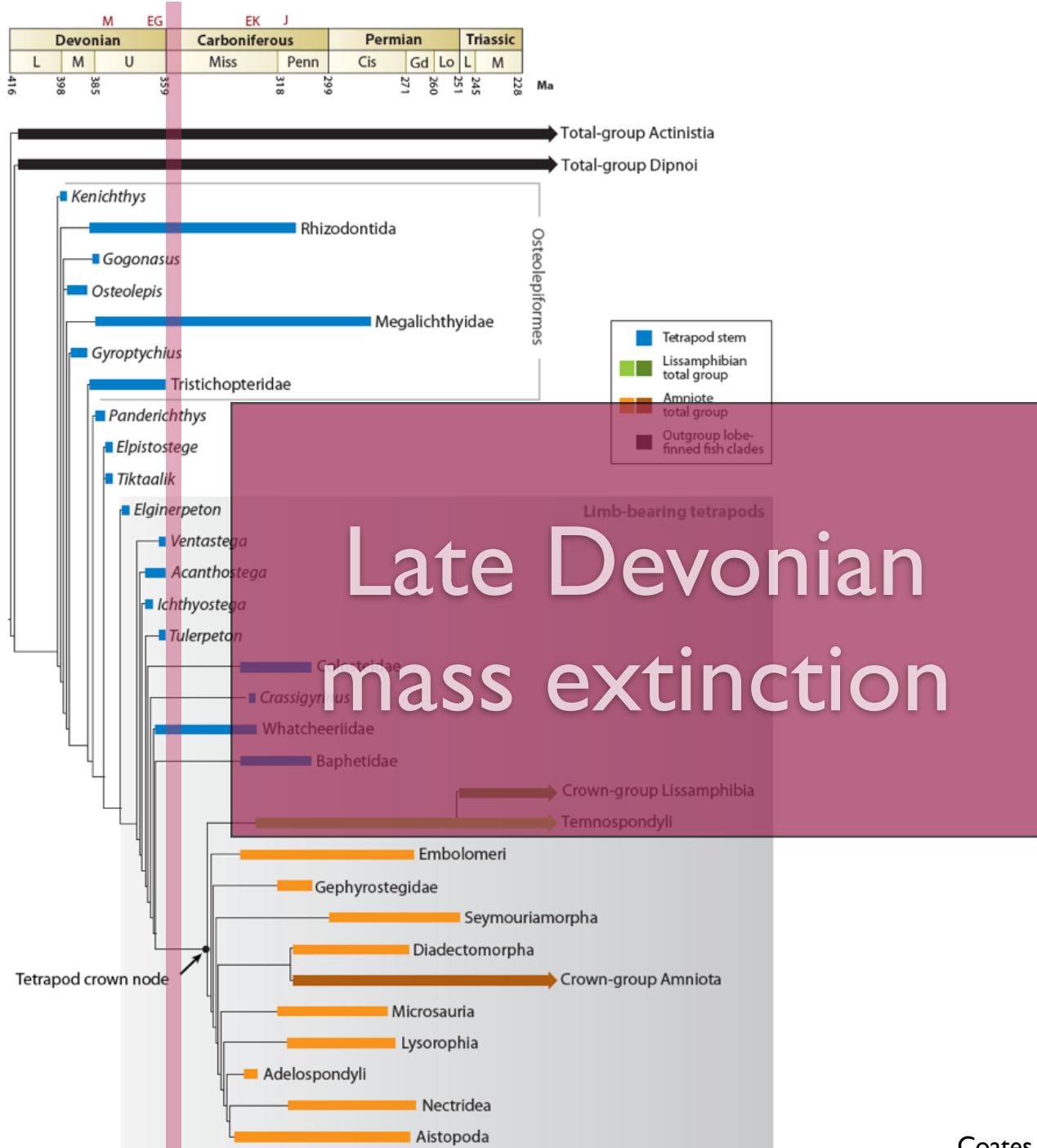
**All of these organisms had limbs but were aquatic!**



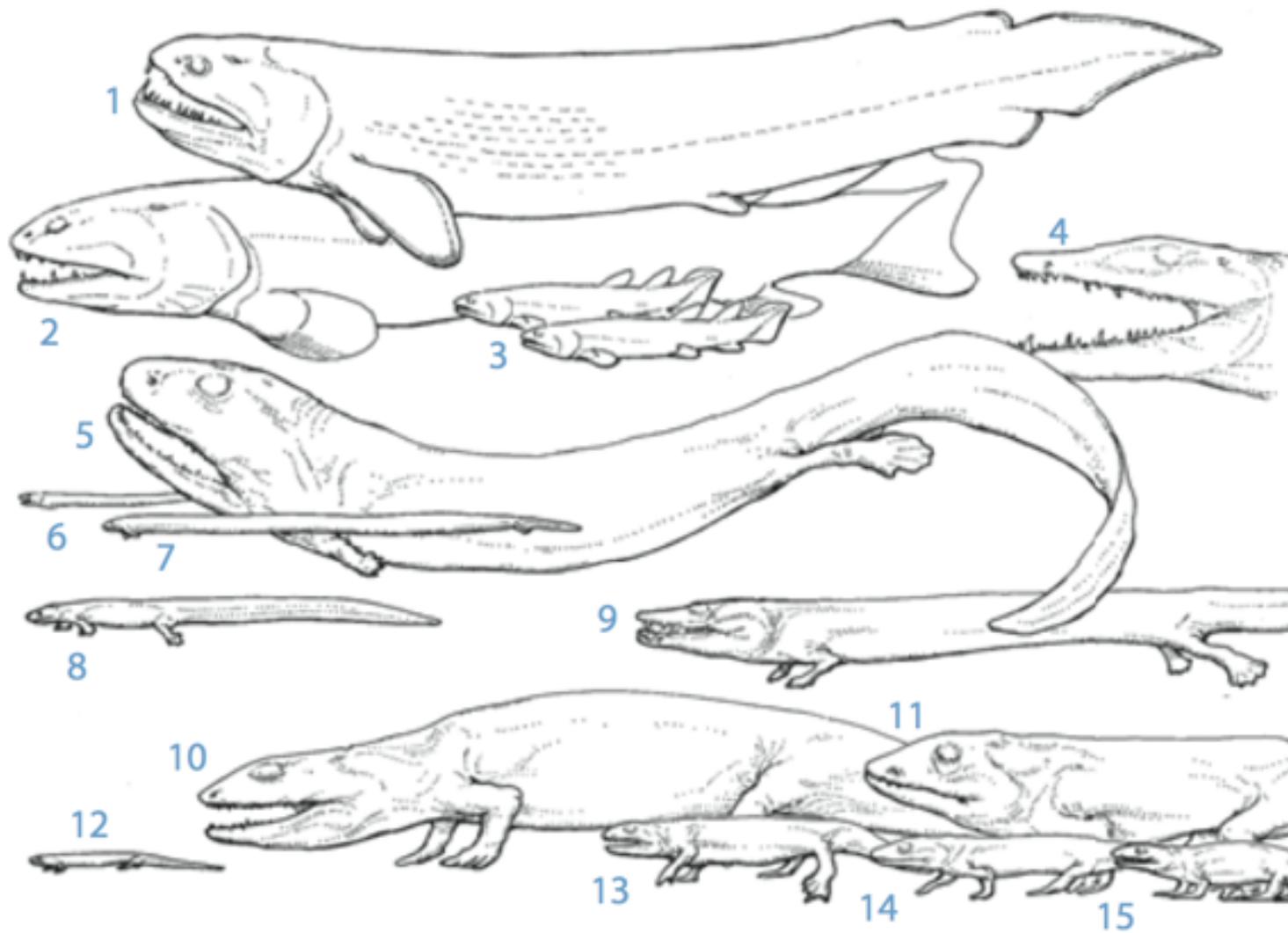
*Dunkleosteus*, a Devonian placoderm







## Carboniferous tetrapods



| m



*Crassigyrinus* will haunt your nightmares

# Things you might think about the transition to land

Legs evolved for locomotion on land

Lungs evolved for breathing on land

# Things you might think about the transition to land

~~Legs evolved for locomotion on land~~

Lungs evolved for breathing on land

# Things you might think about the transition to land

- ~~Legs evolved for locomotion on land~~
- ~~Lungs evolved for breathing on land~~

# Updated Story

- Many features of tetrapods first evolved in an aquatic habitat
- These features turned out to be quite useful when the transition to land occurred
- **Exaptation:** a trait that evolved for one function that is co-opted by selection to serve another function

Ancestry matters!